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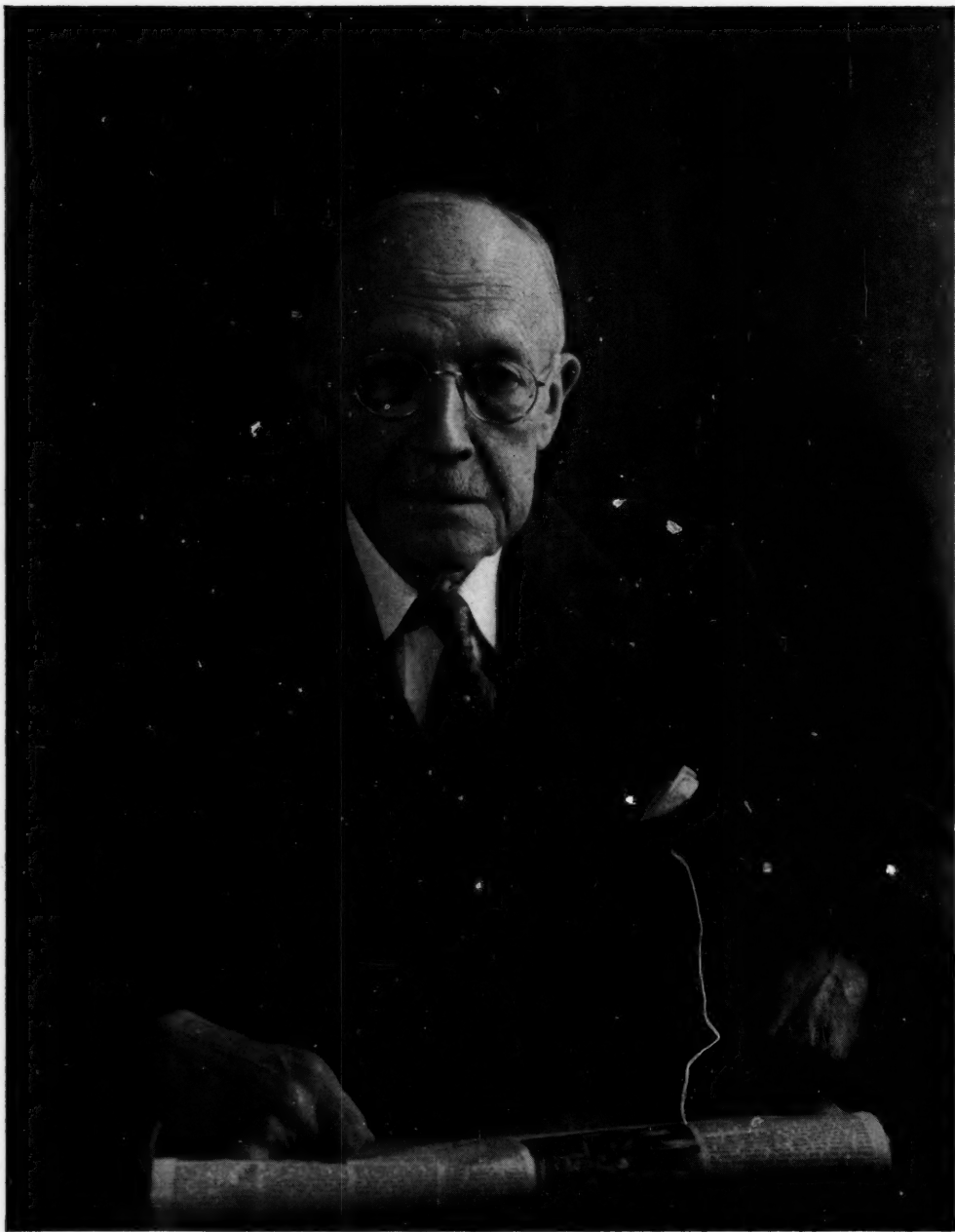
Imogen Cunningham
San Francisco

DR. GEORGE W. KOSMAK

American Journal of Obstetrics and Gynecology

Editorial

Honoring Dr. George W. Kosmak's Eightieth Birthday

Dr. George W. Kosmak, for years the Editor of the AMERICAN JOURNAL OF OBSTETRICS AND GYNECOLOGY, was born on July 24, 1873. The Editors and the Publishers join in saluting Dr. Kosmak on his eightieth birthday, with admiration and affection, for his more than a quarter of a century of service to the JOURNAL and, through it, to the branch of medicine called Obstetrics and Gynecology.

Dr. Kosmak was born in New York City, received his education and spent his professional life there, and from there did the work which in so many ways has influenced the obstetricians and gynecologists of the country. Having received his undergraduate education at Columbia College, he studied medicine at the College of Physicians and Surgeons, where he graduated in 1899. During the following three years he interned successively at the General Memorial Hospital, St. Mary's Hospital for Children, and the Sloane Maternity Hospital. With this background he began his medical career, or rather the three careers, which he has steadily pursued until now.

In 1904 he became an attending surgeon at the New York Lying-In Hospital, a position he held for twenty-two years. He has been a consultant in obstetrics to a half-dozen hospitals in the New York area and until a few years ago an active private practitioner in the city. Perhaps it was this experience with the everyday details of medical work that has made him such a keen judge of the problems of the specialty, as they have appeared on the American scene during the successive decades of his busy professional life.

It is clear, however, to anyone who glances over his long list of accomplishments that he was never content with the scope that a private practice alone could afford him. Dr. Kosmak has held a host of responsible offices in organized medicine, in the special societies of the profession, and on various welfare committees. He is a past president of the Medical Society of the County of New York, former treasurer of the New York State Medical Society and chairman of its Board of Trustees, editor emeritus of the *New York State Journal of Medicine* and for twenty years was a member of the House of Delegates of the American Medical Association. He was for years treasurer of the American Gynecological Society, and, in 1944, its president. He has been chairman of the Medical Board

of the Visiting Nurse Association and continues in that capacity for the Maternity Center Association of New York. In 1930 he was a member of the Committee of the New York Academy of Medicine, which made its now famous analysis of the causes of puerperal mortality.

It is probable, however, that Dr. Kosmak's greatest contribution to obstetrics and gynecology—and we believe that he would be of the same opinion—was his editorship from 1920 to 1952 of this JOURNAL. It was largely his child in the beginning and it has been his hand which has for the most part guided it to its maturity.

The predecessor of the "Gray" JOURNAL was the *American Journal of Obstetrics,* blue in color, and founded in 1868. Of this earlier journal Dr. Kosmak had become an associate editor with Dr. Brooks Wells in 1906, and had succeeded as editor upon the death of Dr. Wells in 1908. In 1919, the publishers of the journal decided to give up its publication and it seemed that the specialty in America was about to be without an organ for publication.

Efforts were at once made to find a new publisher. At first it appeared that a subsidized journal would be necessary, and backing was at hand by such men as Whitridge Williams, John Clark, and Barton Cooke Hirst. However, there soon appeared an alternative proposal, stimulated by Dr. Hugo Ehrenfest and Dr. George Gellhorn of St. Louis, by which the publication of the new journal would be undertaken by The C. V. Mosby Company without subsidy. The latter plan Dr. Kosmak enthusiastically supported because he believed that the new journal could be made worthy without special aid. Having made his decision and undertaken the job, Dr. Kosmak held to it for thirty-odd years, with the results that are now well known.

The AMERICAN JOURNAL OF OBSTETRICS AND GYNECOLOGY appeared on the scene at a critical point in the history of the specialty in America. The time had come when medicine could turn special attention to childbirth, its complications and its sequelae, and the new JOURNAL was borne forward on the tide of development of the science for which it spoke. Yet a little of the reverse was true also, for the JOURNAL carried in its pages for over a quarter of a century most of the best of what was being spoken and written about obstetrics and gynecology. It was the official organ of most of the obstetrical and gynecological societies of the country and was read by all who worked as gynecologists or obstetricians.

For this consummation George Kosmak was largely responsible. History, it is true, was on his side, but it was his faith in the future that gave him the strength to insist in 1920 that there must be a journal in America in this field. Once started, Dr. Kosmak and his JOURNAL helped to create medical history.

It is with these thoughts in mind that we extend to George Kosmak birthday greetings. To these we are sure that the readers of the JOURNAL will add their own.

For birthdays there should be presents. Such a present, in the form of a dedicated number of the JOURNAL, a Festschrift in the old sense, had been planned for Dr. Kosmak's eightieth birthday. Since it was impossible to prepare such a number in time for this July, we wish to announce that the issue is in preparation and will be ready for presentation when another year has passed. We are sorry for the delay, but it will at least give us another occasion on which to do Dr. Kosmak honor.

Howard C. Taylor, Jr.
William J. Dieckmann

Original Communications

MEASUREMENT OF UTERINE BLOOD FLOW AND UTERINE METABOLISM

I. Critical Review of Methods*

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IN RECENT years valuable techniques have been devised to measure blood flow to the kidneys, brain, heart, and liver, and great progress has been made in the study of the circulation and metabolism in these organs. Surprisingly, however, such studies have not as yet been satisfactorily extended to the non-pregnant and pregnant uterus, despite the obvious value which would be derived from knowledge of uterine blood flow and uterine metabolism. These studies probably would contribute to the solution of important problems in obstetrics and gynecology, such as those related to uterine and placental ischemia, uterine inertia, effects of various hormones and other therapeutic agents on uterine and fetal circulation, and presumably also dysmenorrhea and functional uterine bleeding.

The present paper reviews and evaluates the studies which heretofore have been made on the measurement of uterine blood flow in experimental animals and human subjects. It also discusses the possibilities and significance of applying the newer methods and techniques used in measuring the circulation in other organs, in the determination of uterine blood flow and uterine metabolism.

Measurement of Uterine Blood Flow in Animals

Although innumerable studies dealing with circulatory changes in the non-pregnant and pregnant uterus have been reported, almost all of these reports have been limited to qualitative and descriptive aspects of uterine vasculature. Cyclic changes in certain portions of the uterine vascular bed have been well described, and important information has been gained as to the effects of hormones and other therapeutic agents. For a comprehensive review of such consideration, reference may be had to Reynolds'[1] textbook, *Physiology of the Uterus*.

The first measurement of the blood content of the uterus was performed in rabbits by Barcroft and his associates[2] in 1932. Using the technique of simultaneous ligation of the uterine and ovarian vessels, Barcroft washed the veins and extracted the blood content of the entire uterine tissue with heparin, determining colorimetrically the quantity of blood contained in the uterus. He found that, in the resting condition, the genital organs contain about 2 c.c. of blood, increasing to 10 c.c. at mid-pregnancy, and reaching the maximal amount of 30 c.c. at about the twenty-eighth or twenty-ninth day of gestation. The technique used by Barcroft can be applied only to animals, and the methods of vein washing and tissue extraction have many inherent errors. Besides, the procedure reveals only the approximate quantity of blood present in the uterus and ovaries upon their separation from the general circulation. As noted by the authors themselves, no indication is obtained as to the quantity of blood circulating through the uterus in a given period of time, which is the most important question in studying the blood flow to any organ.

In a subsequent study Barcroft and his associates[3] attempted to study in rabbits the quantity of blood circulating in the uterus in a unit of time by performing the following experiment: After an extensive dissection of the abdominal aorta, inferior vena cava, and the pelvic vessels, the uterine vein was cannulated and the other vessels of the pelvis were ligated. The blood pressure of the experimental animal was maintained close to normal levels by cross-transfusion from an animal donor. Samples of uterine blood were collected at one- or two-minute intervals from the cannula inserted in the uterine vein. With this method, the authors were able to measure approximately the quantity of blood flowing from the uterus per minute and from these figures they calculated the oxygen uptake of the uterus at various stages of pregnancy.

The technique used by Barcroft and his associates is subject to errors and takes into consideration many assumptions which might not be correct. The extensive dissection of the aorta and vena cava and the use of clamps around these and other major vessels results in trauma to the vessel walls sufficient to produce alteration in the circulation. Furthermore, the resistance to the blood flow offered by the cannula and the timing for collection of venous samples introduce other variables which make accurate study of the blood flow in the resting state or any other standard condition somewhat difficult. Nevertheless, Barcroft was able to gather some figures which indicate roughly that in rabbits the blood flow and oxygen consumption of the pregnant uterus increase proportionally to the growth of fetal tissue.

Another study of this kind was performed by Robson and Schild,[4, 5] who attempted to investigate the effects of drugs on the blood flow and muscular activity of the uterus. These authors perfused cats' uteri with blood taken from the animals' own aortas, and using an oncometer to record the blood flow, they found no correlation between uterine contractions and the quantity of blood circulating in the uterus.

The method of perfusing the organ from the animal's own aorta is fairly satisfactory for animal experiments provided the blood pressure can be main-

tained at constant levels and injury to blood vessels can be avoided. However, if, for some reason, the animal's own aorta cannot be used or certain circumstances require a perfusion pressure higher or lower than that of the aorta, the use of an artificial perfusion system becomes mandatory. The difficulties in using such a system reside in maintaining the perfusion fluid at constant temperature and fairly well oxygenated, and in preventing sedimentation of red cells and trauma to blood elements and blood vessels.[6] It is probably on account of these difficulties that the perfusion method has not been used more frequently in the study of uterine circulation. However, with the recently improved perfusion apparatus, this method may become useful again in the study of physiology of circulation.

Similar series of observations related to the effect of drugs and pressure variation on the blood flow to the uterus were carried out more recently by Ahlquist and Woodbury[7] using the rotameter. This instrument utilizes the same principle as that employed in constructing gasoline filling machines and consists essentially of direct displacement of a float by a fluid current entering a calibrated cylinder.[6] For full details of this instrument, the reader is referred to several articles dealing with this subject.[6] The rotameter records the mean blood flow to any organ without recording the phasic oscillations which occur during the systolic and diastolic variations of blood pressure. Nevertheless, it is fairly simple and accurate for recording blood flow to various organs in animals, and one wonders why it has not been used more frequently in the study of uterine physiology.

Using this method in pregnant and postpartum dogs, Ahlquist and Woodbury found that when the intrauterine pressure reaches 60 to 70 mm. Hg, the blood flow to the uterus practically ceases. These observations are at variance with those of Robson and Schild who found no relationship between contraction of the uterus and blood flow. The divergency between the results of these two groups of investigators is probably caused by the difference in their methods of study and to a certain degree to some errors inherent in both methods. For these reasons, we believe that the problem or relationship between uterine contraction and blood flow deserves further investigation.

Reynolds,[8] in 1947, also attempted to estimate the uterine blood flow in pregnant rabbits by measuring the circulation time between the uterine vessels and the carotid body. Sodium cyanide was injected into one of the veins of the uterus (usually the lateral) and the blood samples were collected from the maternal carotid body. The uterine blood flow was computed from the reciprocal of circulation time and correlated with changes in the shape of the conceptus. This method of computing blood flow is rather empirical because the measurement of circulation time between the uterus and other areas of the body does not reflect the quantity of blood which circulates in the uterus in a given time. Furthermore, variables such as the velocity of blood, stasis of blood caused by manipulation or other factors, dilution and diffusion of the injected material may influence greatly the circulation time and the concentration of the substance in the blood, thus adding more errors to the calculation.

As far as we know, these are the only contributions existing in the literature regarding quantitative estimation of uterine blood flow in animals. Obviously, the field is still open for more accurate measurement and for more studies regarding variations in flow and metabolism during the various phases of gestation. Such studies, if also carried out in pregnant animals with experimental neurogenic and renal hypertension, may throw light on the participation of the uterus in these hypertensive states.

Measurement of Uterine Blood Flow in Human Subjects

It is obvious that the methods which have been used for measuring the uterine blood flow in animals cannot be applied to human subjects. Estimation of the uterine blood flow in pregnant or nonpregnant women has not been attempted for lack of any adequate and safe method. The techniques of measuring blood flow with the use of clearance of known substances in a manner similar to that used in the study of renal and hepatic circulation cannot be applied to the uterus since this organ, unlike the kidneys and liver, does not specifically and selectively remove foreign substances from the blood stream. Hence, substances such as inulin, mannitol, para-aminohippurate, Bromsulphalein, etc., cannot be employed in the measurement of uterine blood flow in human subjects.

During recent years, new methods for measuring blood flow to organs which do not extract specifically foreign substances from the blood stream have been developed. Among these, the most notable is that related to the use of nitrous oxide for the study of the circulation to the brain.[6, 9, 10, 11] It is not the purpose of this paper to discuss all the details and experiments which led to the development of this method, but a brief description of its principles is appropriate.

Nitrous Oxide Method.—

The measurement of cerebral blood flow by the nitrous oxide method is based on two main principles: (a) The brain absorbs an inert gas which reaches it in solution by way of the arterial blood. (b) Application of the Fick principle which postulates that the quantity of any substance taken up in a given time by an organ equals the total amount of the substance carried to the organ by the arterial inflow less the amount removed by venous drainage during the same period of time. By combining these two principles and after a series of investigations, Kety and his associates were able to derive the following formula by which the cerebral blood flow can be calculated:

$$CBF = \frac{100 \ VuS}{\int_{o}^{u} (A - V) \ dt} \qquad (1)$$

where CBF equals cerebral blood flow, Vu concentration of nitrous oxide in venous blood in time u (usually 10 minutes), S partition coefficient for nitrous oxide between brain tissue and blood, and A and V concentration of nitrous oxide in the arterial and venous blood. The denominator represents the integral for the mean concentration of N_2O at any time, u, measured from the beginning

of inhalation of the gas. The actual technique of measuring cerebral blood flow by the nitrous oxide method consists of drawing simultaneously and at appropriate intervals five pairs of blood samples from the superior bulb of the internal jugular vein and from an artery (usually brachial) during a 10 minute period of inhalation of 15 per cent N_2O. The N_2O concentration in the venous and arterial blood samples is plotted against time (Fig. 1). . The flow is calculated by integrating the area between the two curves and by applying equation 1. This integration yields an expression for the mean concentration of N_2O in arterial and venous blood during the period of inhalation. The blood flow is expressed as cubic centimeters per 100 Gm. of brain per minute. After the blood flow is known, cerebral oxygen consumption and cerebral vascular resistance can be computed according to appropriate equations.
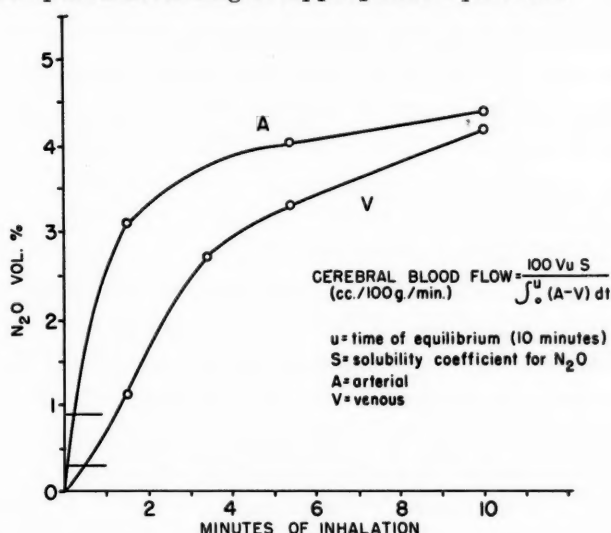
Fig. 1.—Nitrous oxide curves for cerebral blood flow: A, arterial, V, venous. The circles represent the time as well as the exact concentration of the blood samples. (From Schmidt, C. F.: The Cerebral Circulation in Health and Disease, Springfield, Ill., 1950, Charles C Thomas.)

In subsequent studies, Kety[12] demonstrated that the nitrous oxide method can be applied to measurement of blood flow in other organs of the body, provided samples of venous blood can be obtained directly from the veins draining the organ under study. Hence, a technique has been developed and applied to measurement of the coronary blood flow in man. This technique has proved to be of some value in the study of the circulation to the heart.

The accuracy of the nitrous oxide method depends on the following conditions:

A. Careful collection of venous blood samples which would be representative of all the venous drainage from that organ. If the venous samples are mixed with blood coming from other areas, a serious cause of error in the calculation of flow is introduced.

B. Accurate timing of the collection of arterial and venous blood samples. The importance and details of this timing are discussed in a subsequent paper.

C. That the experimental time period (u in equation 1) is sufficiently long so that the N_2O tension in the venous blood will be equal to the tension of this gas in the organ itself.

D. Excessive fat content of an organ alters the accuracy of the method because fat tissue absorbs a large quantity of nitrous oxide. Thus, N_2O equilibrium is not easily achieved within a reasonable period of time and factor S in equation 1 becomes altered.

In 1949 we began in this laboratory a study designed to apply the nitrous oxide method to measurement of uterine blood flow in pregnancy. Evidently, the first problem was to obtain samples of venous blood directly from the uterine vein. This was first accomplished by catheterization of the uterine vein and later by cannulation of this vein during abdominal operation. These two techniques will be described in detail in the following paper.[13]

Calculation of the uterine blood flow was made according to the same formula used by Kety in the study of cerebral blood flow, except the symbols were changed to fit the uterus. Thus equation 2 becomes as follows:

$$UBF = \frac{100 \ VuS}{\int_0^u (A-V) \ dt} \qquad (2)$$

where UBF equals uterine blood flow expressed as cubic centimeters per 100 Gm. per minute; the other symbols are the same as in equation 1.

The causes of errors which are inherent in the use of the N_2O procedure for measurement of uterine blood flow are the following:

A. Catheterization of the uterine vein on the right side or its cannulation during cesarean section might not reflect the nitrous oxide concentration of the left side of the uterus, particularly if the placental blood is drained by the left uterine vein. Catheterization or cannulation of both uterine veins has not been attempted as yet because of the hazard and difficulties involved in this procedure.

B. Sampling of venous blood from the uterine vein probably does not include the blood which is drained through the tubovarian vessels. Furthermore, there is a possibility that in some instances the uterine vein itself might be draining blood from other surrounding structures such as bladder, vagina, etc.

C. The partition coefficient of nitrous oxide is probably different for the uterine, placental, and fetal tissues and the values given to factor S in equation 2 may not represent the true values for these tissues. This question becomes more pertinent in view of the excessive fat content of the fetal tissue. Plans are being made to determine the exact partition coefficient of these different tissues, thus eliminating this possible source of error.

Despite these serious causes of error, we still believe that it is possible to estimate approximately the uterine blood flow in human pregnant subjects with the N_2O method. Such estimation may become more accurate if the partition coefficients of the various tissues involved are determined and the uterine veins on both sides are cannulated. In the study of the nonpregnant uterus, many of these errors probably are much less significant and the application of

the method may give better results. Full discussion of the results obtained with the application of this method in pregnant subjects will be the object of a further report.[14]

The oxygen consumption of the pregnant or nonpregnant uterus can be calculated from the values of uterine blood flow according to equation No. 3:

$$UMRO_2 = \frac{UBF \times (A-V)\ O_2}{100} \tag{3}$$

where $UMRO_2$ represents the oxygen consumption of the uterus expressed as cubic centimeters of oxygen per 100 Gm. of uterus per minute, UBF equals uterine blood flow and $(A\text{-}V)O_2$ equals the difference in concentrations of O_2 in arterial and venous blood. This latter can be determined from blood samples obtained before the beginning of N^2O inhalation.

The resistance offered by the uterine vessels to the flow of blood can be roughly calculated from equation 4:

$$UVR = \frac{MBP}{UBF} \times 1328 \tag{4}$$

where UVR represents uterine vascular resistance expressed as dynes. sec. cm.$^{-5}$ and MBP the mean arterial blood pressure. This latter can be obtained by direct measurement from the brachial artery with the aid of a Hamilton manometer or by adding one-third of the pulse pressure to the diastolic pressure.

Dye Method.—

The dye method for measuring the blood flow to the brain was developed following Stewart's principle[6, 15] which states the following:

Consider a substance (T-1824) which does not leave the circulation of the organ in question injected into the artery of such an organ; and that this substance suffers such mixing in the organ that its concentration is uniform in all of the veins which leave it. If

A = concentration of dye in arterial blood
V = concentration of dye in venuos blood
I = quantity of dye injected in time $(T_2 - T_1)$

the cerebral blood flow can be calculated from equation 5:

$$CBF = \frac{1}{\int_{T_2}^{T_1} (V-A)\ dt} \tag{5}$$

Gibbs and associates[16] have simplified this formula and reduced it to equation No. 6:

$$CBF = \frac{R}{V-A} \tag{6}$$

where R equals the rate of the dye injection.

The method of dye determination can be applied to measurement of uterine blood flow, provided the following technical details are met:

A. Identification and separation of the uterine artery and vein.

B. Injection of an exact and known quantity of T-1824.

C. Constant and accurate timing of the injection and collection of venous samples.

The major difficulty, of course, resides in identification and dissection of the uterine vessels, but after this is performed the procedure becomes relatively simple. Here, again, the technique would be more accurate if both sides of the uterus were studied.

Measurement of the uterine blood flow by the dye method affords an excellent opportunity to study the circulation of the uterus alone without interference of that of the placenta and fetus, since the dye T-1824 does not traverse the placental barrier. If this method is used simultaneously with the N_2O method, estimation of the blood flow to the uterus and to the fetus and placenta can be made separately. After these figures are obtained, calculation of the metabolism of these different parts becomes a matter of simple mathematics. Plans are being made in this laboratory to attempt the application of the dye method to the study of uterine blood flow in human pregnancy.

Comments

The study of the blood flow and metabolism of the pregnant and non-pregnant uterus in both animals and human subjects has not received much attention from investigators. In animals, various improved techniques and methods can be used in measuring directly the blood flow which circulates in the uterus per minute. These studies might advance markedly our knowledge regarding many problems of uterine physiology. In human subjects certain difficulties hamper the study of uterine blood flow and uterine metabolism. Nevertheless, it is still possible to perform such studies by applying newer techniques which have been used in the study of cerebral circulation. Although the application of these techniques to the study of uterine circulation is still in its embryonic stage and needs much elaboration, it does seem to offer a promising field of investigation in genital physiology.

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MEASUREMENT OF UTERINE BLOOD FLOW AND UTERINE METABOLISM

II. The Techniques of Catheterization and Cannulation of the Uterine Veins and Sampling of Arterial and Venous Blood in Pregnant Women*

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IN THE preceding paper[1] the subject of measurement of uterine blood flow and uterine metabolism was reviewed and the methods which could be applied to this study in human pregnancy were discussed. The present report deals with details of the techniques of catheterization of the uterine vein or its cannulation during abdominal operation. For a better understanding of the technical steps involved in these procedures, it would be appropriate to describe briefly the arrangement of the blood vessels in the pregnant uterus, although this subject is fully covered in many articles and textbooks of anatomy.[2,3]

Arterial Supply of the Uterus.—The arterial supply of the uterus is derived primarily from the uterine arteries which are branches of the anterior division of the hypogastric (internal iliac) artery. Occasionally the uterine artery arises from a stem common to it and to the vaginal artery. On each side the uterine artery runs to the lower border of the broad ligament, arches over the ureter, and enters the Mackenrodt ligament. Then, approximately at the level of the internal os, it ascends in a tortuous manner, giving to the uterus anterior and posterior branches which anastomose with branches coming from the other side. The uterine artery terminates by anastomosing, at the level of the ovary, with branches coming from the ovarian artery. Besides supplying the uterus, tubes, and part of the ovary, the uterine artery also gives branches which supply the cervix and upper part of the vagina.

Uterine Veins.—More important for the technique of measurement of uterine blood flow is knowledge of the arrangement of the veins which drain the blood from the uterus. Anatomists describe the venous arrangement of the uterus as consisting usually of an agglomeration of veins which form the uterine venous plexus. This plexus, which is a part of the pelvic venous plexuses, is composed of thin-walled veins which have no valves and which communicate freely with the ovarian plexus and occasionally with other plexuses, tributaries of the hypogastric veins. The uterine plexus empties on each side into two major uterine veins. These veins run parallel to the uterine artery and end by emptying themselves into the hypogastric veins.

The uterine veins and their tributaries assume enormous proportions during pregnancy, a fact which should make their identification relatively simple. However, very often in full-term pregancy, because of the enlarged uterus, surgical exposure of these veins becomes rather difficult.

I. Catheterization of the Uterine Vein

A. Equipment Necessary.—

1. Extra long (136 cm.) Cournand single lumen No. 8F or 9F catheter* (Fig. 1) which can usually be kept sterile in a solution of Zephiran ($\frac{1}{1,000}$).

2. At least 3 dozen 10 c.c. Luer-Lok syringes with an equivalent number of needles, preferably No. 20. These syringes and needles should be kept dry and sterile in a tray which should also include:

3. Sterile syringes of 5 and 2 c.c.

4. Two No. 18 Cournand needles for arterial puncture.

5. Four to 6 three-way stopcocks and 5 to 6 pieces of polyethylene tubing of varying lengths and diameter. One of these pieces should be of the same diameter as that of the end of the stopcock.

6. Medicine glasses, gauze pads, clamps, and several towels and field sheets, sterile gowns and gloves for the operator.

7. A bottle containing sterile saline solution containing 2 c.c. of heparin for each 300 c.c. of saline. This solution, which will be called Solution A, is infused through the catheter in order to keep it patent.

8. Another sterile heparin solution containing 2 c.c. of heparin for each 10 c.c. of saline, which will be called Solution B, and serves for rinsing and flushing the tubes, syringes, and manifolds.

9. Two sets of manifolds as shown in Fig. 2. These could be fixed to a side board or to an intravenous stand.

Other equipment which should be available and can be used without being sterile is the following:

1. Gas cylinder, type G, containing 15 per cent nitrous oxide, 21 per cent oxygen, and 64 per cent nitrogen.†

2. Thirty obliterated needle hubs to fit the 10 c.c. syringes.

3. A small pan or preferably a bowl half full of mercury.

4. A bucket full of crushed ice.

5. Electrocardiographic machine and a Hamilton type manometer, preferably the Hathaway direct blood pressure recording machine.

B. Procedure.—

In order to obtain full cooperation, the patient who is to be studied should be selected and informed about the procedure. Patients who are apprehensive or sensitive to radiation should be eliminated.

On the evening preceding the day of the study, small doses of barbiturates are administered. On the morning of the procedure, breakfast is omitted and the patient is given 20 mg. of morphine (intramuscularly) and 200 mg. of Seconal. She is then moved to the radioscopic room and placed supine on the fluoroscopy table. The operator should be prepared to perform a sterile procedure. The Cournand catheter is first connected to the bottle containing the heparin solution (Solution A) and this is allowed to run until the tube is completely rinsed. The patient's right arm is scrubbed and prepared and an ante-

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*United States Catheter and Instrument Corp., Glen Falls, N. Y.
†National Cylinder Gas Co., Cleveland, Ohio.

cubital vein (preferably the basilic) is exposed through a small transverse incision. Two medium silk ties are passed around the proximal and distal parts of the veins. The catheter is then introduced into the vein through a small incision and directed toward the axillary vein (Fig. 3). Thereafter, Solution A is allowed to run at a rate of 30 to 40 drops a minute. The catheter is advanced slowly under fluoroscopic examination to the right innominate vein,
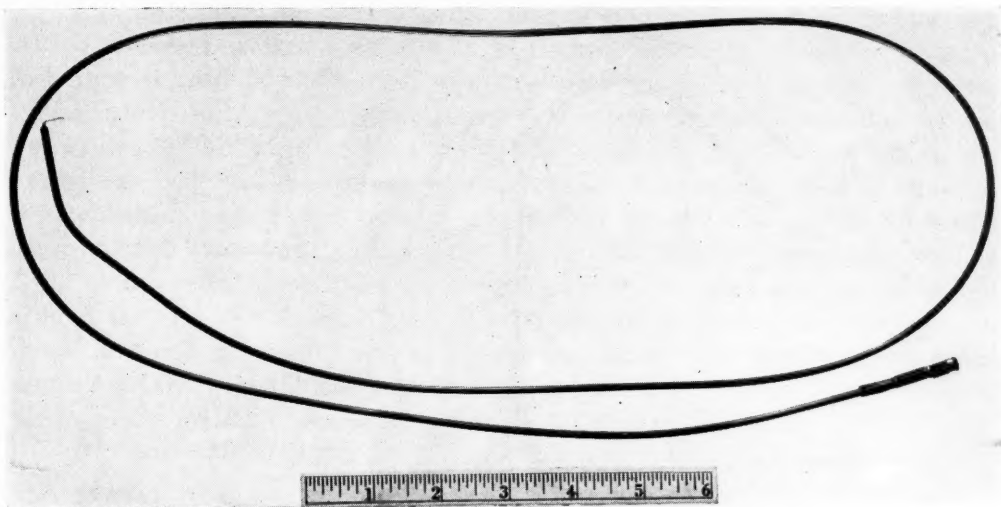
Fig. 1.—Cournand single lumen extra long catheter.
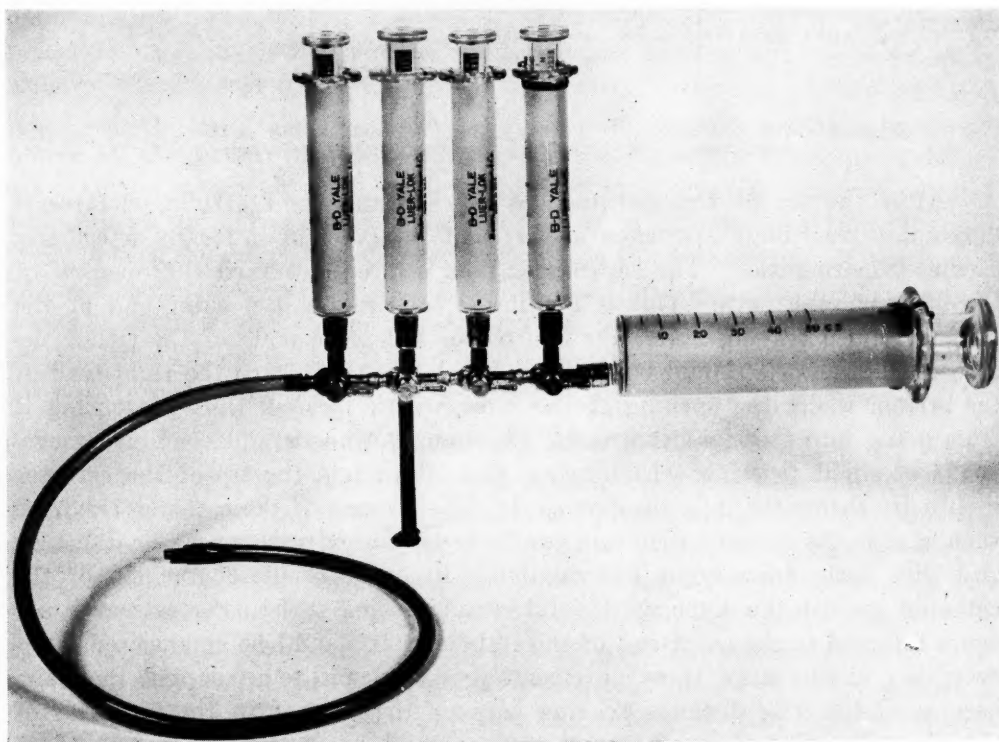
Fig. 2.—Manifold for fixing the syringes and drawing blood samples. The 50 c.c. syringe at the end contains the flushing solution.

the superior vena cava and right atrium. The progressing of the catheter
toward the right atrium can be facilitated by inflicting small movements of
abduction and adduction to the arm of the patient. Changes in the direction
of the tip of the catheter are accomplished by exerting twisting movements to
the outer end of the catheter.
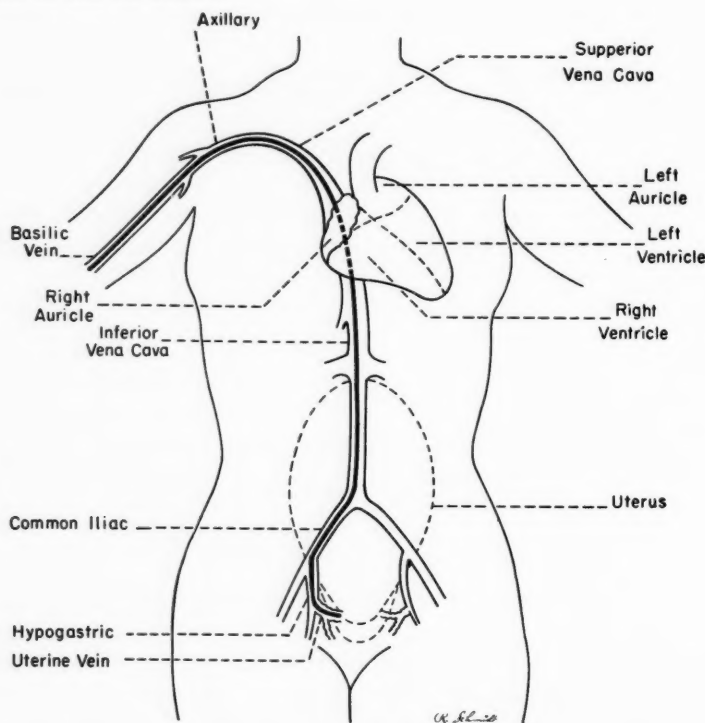
Fig. 3.—Schematic representation of the trajectory covered during catheterization of the
uterine vein.   The thick black line represents the catheter.

After the tip of the catheter has reached the right atrium, electrocar-
diographic recordings are taken at frequent intervals in order to detect any
cardiac abnormalities. The catheter is then advanced toward the opening of
the inferior vena cava. This is facilitated by twisting the outer end of the
catheter and observing under the fluoroscope the movements of the tip of the
catheter. All efforts should be made to direct this tip toward the right wall of
the atrium where the opening of the vena cava is located, thus preventing it
from going into the right ventricle. Through continuous and combined move-
ments of slight twisting, withdrawing, and advancing, the tip of the catheter
eventually enters the inferior vena cava. The passage of the catheter from the
vena cava to the common iliac vein can be accomplished without major difficulty
and with little fluoroscopic examination. In order to direct the tip of the
catheter toward the hypogastric and uterine veins, twisting movements are
again inflicted to the outer end of the catheter. It should be emphasized, how-
ever, that, at this stage, these movements very often fail to accomplish their aim
because of the long distance existing between the location of the two ends of
the catheter. Therefore, the movements should be continued and frequent
fluoroscopic examinations are necessary in order to observe the site of the tip

of the catheter. With persistent effort, the catheter will eventually reach the hypogastric and finally the uterine vein.

When, under the fluoroscope, the tip of the catheter is seen close to the uterine wall, or better, in the proximity of the fetus, it is almost certain that it has entered the uterine vein.

II. Cannulation of the Uterine Vein During Abdominal Operation

This procedure can be performed during cesarean section or during any other abdominal operation. The same equipment utilized in the catheterization technique is used in the cannulation procedure, with the exception of metal cannulae or polyethylene tubes which are substituted for the Cournand catheters. The entire procedure of cannulation of the uterine vein is carried out in the operating room and under sterile conditions. The uterine vein is exposed through an incision of the anterior sheet of the broad ligament, the dissection being carried downward through the Mackenrodt ligament until the vein is freed as much as possible from the surrounding tissue. Two silk ties are passed around the vein and a metal cannula or a piece of polyethylene tube is introduced into its proximal part and directed toward the uterine walls. The cannula or the polyethylene tube is then connected by another long tubing to the manifold system which is located outside the operative field.

III. Arterial Puncture

The arterial blood samples are obtained directly from the brachial or radial artery. Puncture of the brachial artery is usually made with the aid of Cournand needles. The skin of the antecubital area over the site of the arterial pulsations is infiltrated with 1 per cent procaine solution and the puncture is made with the tip of the needle directed cephalad. "Hitting" of the artery is easily recognized by the gushing of bright red blood. The needle is then connected to the proper manifold by polyethylene tubing. When the brachial artery is not accessible to direct needle puncture, the radial artery is exposed and utilized through a simple "cut down." It is important to know that, in order to keep the arterial needle patent, slow injection of heparin solution should be made continuously with a positive pressure. Puncture of the brachial artery does not produce any serious ill effect to the patient. Transitory paresthesia of the arm utilized for puncture may occasionally occur. Hematoma around the puncture site was seen in a few cases but was without consequence.

IV. Collection of Venous and Arterial Blood Samples

The technique of collection of blood samples is the same regardless of whether the catheterization or the cannulation procedure is used. The time for withdrawing the arterial and venous samples as well as the intervals between each sample and other details are listed in Protocol I which represents the procedure carried out on one patient. It should be emphasized that correct timing and simultaneous collection of both arterial and venous samples are of particular importance in determining the accuracy of the method. Before a blood sample is withdrawn, the manifold and tubing systems are first flushed with Solution B and then immediately cleared of this solution by aspirating all the fluid with the 50 c.c. syringe located at the end of the manifold. In this way,

dilution of the blood by the flushing solution is avoided. The first sample of venous blood (Vx) is taken and serves as blank. The administration of nitrous oxide is then started and continued without interruption in an open system until the end of the procedure. It is important that the gas mask be fitted properly in order to secure a constant rate of N_2O administration. Otherwise, the concentration of this gas in the blood samples will tend to vary and the plotting of the curves becomes difficult. Air bubbles in the syringes should be avoided as much as possible, and, if present, should be expelled immediately. Mercury is aspirated into the syringe containing the blood samples immediately after these are removed from the manifold. Each syringe is then sealed with an obliterated needle hub and placed in ice until the time to be analyzed for its content of nitrous oxide, oxygen, and carbon dioxide.

PROTOCOL I.—NITROUS OXIDE TECHNIQUE FOR UTERINE BLOOD FLOW.

Name: C. F.; age: 27 years; diagnosis: normal pregnancy, 37 weeks; date: April 17, 1952.

TIME		VENOUS SAMPLE*	ARTERIAL SAMPLE*
−0′45″− 0′29″	flush		
−0′30″− 0′00″		$Vx = 10$ c.c. (1 c.c./3 sec.) blank	--
0′00″	start N_2O		
0′01″− 0′14″	flush		
0′15″− 1′15″		$V_1 = 6$ c.c. (1 c.c./10 sec.)	A_1
1′15″− 1′30″	flush		
1′30″− 2′30″		V_2	A_2
2′30″− 2′45″	flush		
2′45″− 3′45″		V_3	A_3
2 minute interval		Prepare syringes for following samples; remove samples drawn from manifold, aspirate mercury, and place in ice.	
5′30″− 5′45″	flush		
5′45″− 6′45″		V_4	A_4
8′30″− 8′45″	flush		
8′45″− 9′45″		V_5	A_5
14′30″−14′45″	flush		
14′45″−15′45″		V_6	A_6
20′30″−20′45″	flush		
20′45″−21′45″		V_7	A_7
26′30″−26′45″	flush		
26′45″−27′45″		V_8	A_8
		If possible, further samples are taken at 5 minute intervals.	

*The venous and arterial samples are taken at a rate of 1 c.c./10 sec. (6 c.c.) with the exception of Vx.

Comment

It is evident from the description of the various steps involved in the catheterization and cannulation of the uterine veins that certain hazards and difficulties are involved in carrying out either of these procedures. Catheterization of the vein per se does not involve serious risk to the patient, provided a careful selection of the individual is made. Cardiac arrhythmia occurs very frequently during the passage of the catheter through the right atrium, but this arrhythmia usually disappears soon after the end of the procedure. The major risk involved in the catheterization technique is related to the amount of radiation to which the patient, fetus, and operator are exposed. This risk can be diminished by limiting as much as possible the number as well as the length of the fluoroscopic examinations. Usually two to three examinations of 5 to 10

seconds' duration are necessary until the catheter reaches the heart. A longer time is needed for the catheter to pass from the right atrium to the vena cava, and, therefore, exposure to radiation is more prolonged. From the vena cava to the iliac veins, the number of fluoroscopic examinations can be reduced because no major obstacles to the passage of the catheter are encountered. From this point to the uterine vein, the time consumed is rather long and the number of exposures varies from one case to another. Despite all these possible risks, we have not seen serious radiation effects in any of the cases studied.

Another danger of catheterization is the possible occurrence of pulmonary embolism. This, however, is rarely observed and should not constitute a reason against the use of this procedure. The main drawback of this technique is that the failures in passing the catheter into the uterine vein far outnumber the successes. On the other hand, collection of venous blood samples through catheterization of the uterine vein offers several advantages. The procedure requires neither a special operating room nor opening of the abdominal cavity. Furthermore, because of the minimal possibilities of contamination, the inhalation of nitrous oxide can be prolonged beyond 30 minutes, thus allowing better equilibrium of N_2O in maternal and fetal tissue.

The difficulties involved in cannulation of the uterine vein during abdominal operations reside chiefly in adequate exposure of the main venous channel since the enlarged pregnant uterus frequently obscures the operative field. Also, because of their thin walls, manipulation of these veins becomes a hazardous and delicate procedure. However, after some training and experience, this problem becomes less important. Another difficulty which occasionally occurs during the cannulation procedure is that after one or two venous samples are withdrawn, the cannulated vein either collapses or becomes spastic, so further obtention of venous blood becomes difficult. This condition does not occur frequently but, when it occurs, cannulation of another vein becomes mandatory.

One serious objection to the use of the cannulation technique is that the number of venous blood samples which can be obtained is limited, since the abdominal cavity cannot be left open and the operation cannot be delayed for more than 20 to 25 minutes without involving a risk to the patient and fetus. Therefore, complete nitrous oxide equilibrium may not be accomplished within this period of time. However, it is possible that in the hands of a well-trained team this problem may be eliminated.

Summary

The techniques of catheterization and cannulation of the uterine veins and sampling of venous and arterial blood for measurement of uterine blood flow have been described. The advantages, disadvantages, and difficulties of each technique are discussed.

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THE VOLUME OF DISTRIBUTION OF INULIN, ANTIPYRINE, AND RADIOSODIUM DURING NORMAL AND TOXEMIC PREGNANCY AND DURING THE PUERPERIUM

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THE importance of the distribution of water and electrolytes in pre-eclampsia has been emphasized by many investigators. That sodium is retained is well substantiated, but no significant increase in serum sodium concentration has been found.[1-4] It has therefore been suggested that the retained sodium is stored in an osomtically inactive form,[5] that a large amount of sodium and water is confined within the muscle cells,[6] while alternatively it is conceivable that the extracellular fluid volume simply expands isotonically.

The extracellular space in normal and pathological pregnancies has been previously studied only with the use of thiocyanate. The expansions detected with this method are difficult to interpret.[7, 8, 9] Thiocyanate does not fulfill the basic requirement of exclusive distribution in the extracellular space; it is bound to protein and penetrates erythrocytes, gastric mucosa, and other tissues.[10-14] Under the most favorable circumstances it measures a volume variably intermediate between total body water and extracellular fluid volume.[15] In certain pathological states such as bacteremia, spotted fever, malaria, and artificial hyperpyrexia, the thiocyanate space may approach the value for total body water. Altered cellular permeability may, therefore, under special circumstances invalidate the use of thiocyanate volume even as a gross index of extracellular space.[16, 17, 18] Such an altered permeability may well obtain in pre-eclampsia.[6, 19] It seemed necessary, therefore, to utilize a substance for the measurement of extracellular fluid volume which, under abnormal circumstances, would more likely be limited to extracellular distribution.

Considerable evidence, albeit inferential, has accumulated to indicate that the volume of distribution of inulin affords a reliable index of the extracellular fluid volume.[20, 21, 22] Additionally, it has been demonstrated that the simultaneous measure of total body water with deuterium oxide or antipyrine, exchangeable sodium with radioactive sodium, and inulin space provide a technique to assess the distribution of sodium and water between the interstitial fluid and the tissues.[15, 23] Accordingly, it was considered pertinent to utilize these measuring substances simultaneously in order to evaluate more precisely the alterations in fluid and electrolyte distribution in pre-eclampsia.

Clinical Material and Procedure

Simultaneous T-1824, inulin, sodium[24], and antipyrine space determinations were made in thirteen patients from the Obstetrical and Gynecological Service of the Sloane Hospital for Women. Seven of these subjects had been admitted with the diagnosis of pre-eclampsia; four cases were considered to be severe and three mild, according to the classification of Dieckmann.[24] Two other subjects with pathological pregnancies were studied, one with a severe anemia, and one with triplets, hydramnios, and marked edema of the legs. Two women with normal pregnancy and two nonpregnant women were studied as controls. Additionally, these studies were repeated in the pre-eclamptic subjects during the puerperium, nine to sixty-three days subsequent to delivery, and after the disappearance of all signs of toxemia.

The toxemic patients were maintained on a low-salt diet and all the subjects were studied under as nearly basal conditions as possible after an overnight fast.

Renal clearances were determined in the usual manner, with serial clearance periods of thirty minutes. Each urine sample was collected by catheter and the bladder was washed with distilled water and air.

The inulin space was determined by the postinfusion method of Gaudino, Schwartz, and Levitt.[20, 21, 22] A priming injection of inulin suitable to yield a plasma concentration of 30 mg. per cent was followed by a sustaining infusion of inulin in sterile isotonic saline. The rate of the infusion was maintained constant at 1 c.c. per minute by a Murphy drip and a calibrated Nylon catheter in the antecubital vein. The infusion was maintained for five hours in each inulin space measurement. The postinfusion urine was collected for 20 to 24 hours (a period adequate to ensure virtually complete recovery of administered inulin in man).[21, 22]

The antipyrine space was measured by the method of Soberman and associates.[25] Antipyrine was administered intravenously from a calibrated burette and subsequent blood samples were drawn at 2, 3, and 5 hours. The equilibrium plasma concentration was determined by extrapolating back to zero time. The sodium space was measured by the in vivo dilution of sodium[24]. A known number of counts was injected intravenously and the radioactivity of plasma samples drawn at 1, 2, 2½, 3, and 5 hours was compared with an aliquot of the infusion. Sodium space was calculated as follows:

$$\text{Sodium Space (liters)} = \frac{\text{Counts injected} - \text{Counts lost in urine}}{\text{Counts per min. per liter of plasma at five hours}}$$

No correction was made for the excess sodium in bone.[10] The plasma volume was determined by the method of Gregersen and co-workers[26] using a 20 minute equilibrium time.

Inulin was analyzed by the method of Alving, Rubin, and Miller[27] and antipyrine by the technique of Brodie and collaborators.[28] Sodium was measured with a thin-walled Geiger-Müller counter, with suitable corrections for background.

TABLE I. VOLUME OF DISTRIBUTION OF ANTIPYRINE, RADIOACTIVE SODIUM, AND INULIN IN PRE-ECLAMPSIA

| SUBJECT | TIME FROM DELIVERY (DAYS) | WEIGHT (KG.) | VOLUME OF DISTRIBUTION | | | | | | INSULIN CLEARANCES (C.C./MIN.) | PLASMA VOLUME (T-1824) | | HEMATOCRIT (PER CENT) | INTRACELLULAR FLUID* (ANTIPYRINE SPACE-INULIN SPACE) | |
			ANTIPYRINE (L.)	Na24 (L.)	INULIN (L.)	ANTIPYRINE (% BODY WGT.)	Na24 (% BODY WGT.)	INULIN (% BODY WGT.)		ML.	ML./KG.		L.	PER CENT
P.T.†	14	68.8	37.5	26.4	9.9	54.4	38	14.3	88.7	3,167	46	39.9	27.65	40.2
M.N.*	25	85	47.5	32.4	15.8	55.8	31.1	18.6	103.9	4,908	57.7	39	31.65	37.2
A.B.*	8	68.6	45.2	24.2	7.35	65.9	35.2	10.7	137.1	3,485	50.8	38.1	37.89	55.2
L.S.	4	68.6	41.2	19.5	–	60.1	28.4	–	60.9	–	–	31.1	–	–
A.M.*	30	59	36.9	18.9	12.0	62.6	32	20.4	64.8	2,253	38.2	38.4	24.88	42.2
I.P.	14	64.5	38.7	20.3	13.4	60	31.5	20.8	83.6	–	–	39.3	25.28	39.2
A.Mo.	36	84	54.9	24.1	–	65.4	28.7	–	58.5	4,469	53.2	31	–	–
Mean values for P.T., M.N., A.B., A.M., only		70.3	43.1	23.7	11.70	60.6	33.1	16.96		3,656	48.8		29.47	42.8
			41.79	25.5	11.27	59.7	35.8	16					30.51	43.7

*1.5 to 2 liters should be subtracted from those figures, accounting for water contained in conception product.

TABLE II. VOLUME OF DISTRIBUTION OF ANTIPYRINE, RADIOACTIVE SODIUM, AND INULIN IN PREGNANT AND NONPREGNANT WOMEN

| SUBJECT | DAYS ANTE PARTUM | WEIGHT (KG.) | VOLUME OF DISTRIBUTION | | | | | | INULIN CLEARANCE (C.C./MIN.) | PLASMA VOLUME | | HEMATOCRIT (PER CENT) | INTRACELLULAR FLUID (ANTIPYRINE SPACE-INULIN SPACE) | |
			ANTIPYRINE (L.)	Na24 (L.)	INULIN (L.)	ANTIPYRINE (% BODY WGT.)	Na24 (% BODY WGT.)	INULIN (% BODY WGT.)		ML.	ML./KG.		L.	PER CENT
A. Normal Nonpregnant Women.—														
E.M.		52.3	27.7	15.1	7.64	53	28.3	14.3	88.3	2,276	43.5	42	20.09	38.7
J.W.		57	34.2	17.1	–	59.9	29.9	–	106.8	2,970	52.1			
B. Normal Pregnant Women.—														
J.R.	28	80	42.50	20.8	18.0	53.2	26	22.5	102.1	3,140	39.3	38.9	24.46	30.7
M.J.	17	62.1	35.1	18.4	12.9	56.4	29.6	20.7	66.7	3,168	51	37.5	22.18	35.7
C. Pathological Pregnancies.—														
E.H.*	43	58	34.8	20.4	13.3	59.9	35.2	22.9	99.4	4,552	76.7	21.1	21.49	37.0
L.D.†	13	72.7	48.2	25.0	11.7	66.2	34.3	16.1	90.4	4,411	60.7	35	36.48	50.1

*E. H., Severe microcytic, hypochromic anemia of unknown origin. Red blood count 2.48 million, serum protein, 5.41.
†L. D., Triplets, hydramnios, edema.

Permeability of the Placenta to Antipyrine, Inulin, and Radioactive Sodium

In any study of the distribution of fluid or electrolytes during pregnancy, the permeability of the fetal spaces to the measuring substances must be determined.

A. Antipyrine.—The diffusion of antipyrine into the amniotic fluid was evaluated in one patient. One Gm. of antipyrine was injected intravenously five hours prior to cesarean section, and at operation samples of blood and of amniotic fluid were collected simultaneously. The concentration in the two samples was found to be identical, suggesting that the placenta is freely permeable to this material.

B. Inulin.—Lambiotte and Rosa[29, 30] have previously shown that inulin introduced into the mother's circulation does not appear in the amniotic fluid except during delivery when the placental wall is damaged. Similarly, inulin injected into the amniotic cavity cannot be detected in the mother's plasma. Because of the failure of inulin to penetrate the amniotic sac, the inulin space presented in these data excludes fetal extracellular water.

C. Radioactive Sodium.—Vosburgh and associates[31] found that thirty minutes after the injection of sodium[24] into the maternal circulation the amniotic fluid Na^{24} concentration reached only a small fraction of that in the maternal blood. Flexner and co-workers[32] showed that the permeability of the placenta to sodium varies about seventy fold between the ninth week of gestation and term. The degree of penetration of Na^{24} into the fetal tissues in these experiments is unknown. Incomplete or irregular penetration into the fetal tissues may have produced an error of some proportions in the sodium spaces reported here.

Results

1. Pre-eclampsia.—The values obtained for body weight, antipyrine, sodium[24], and inulin spaces in seven pre-eclamptic subjects are recorded in Table I. In these subjects the antipyrine space averaged 43.1 liters (range 36.9-54.9), the sodium space 23.7 liters (18.9-32.4), and the inulin space 11.7 liters (7.4-15.8). In terms of percentage of body weight, these indices averaged 60.6 per cent, 33.1 per cent, and 17.0 per cent, respectively. No clear-cut correlation was detected between the degree of clinical edema and the antipyrine, sodium, or inulin space.

2. Normal Pregnancies and Normal Women.—The results in these four subjects are presented in Table II. In two normal subjects the antipyrine space averaged 31 liters (27.7-34.2), the sodium space 16.1 liters (15.1-17.1), and the inulin space 7.6 liters. Expressed as percentage of body weight, these spaces averaged 56.4 per cent, 29.1 per cent, and 14.3 per cent, respectively. In two normal pregnant women the antipyrine space averaged 37.8 liters (35.1-42.5), the sodium space 19.6 liters (18.4-20.8), and the inulin space 15.4 liters (12.9-18.0). These values correspond to 54.8, 27.8, and 21.6 per cent of body weight, respectively.

3. Pathological Pregnancies.—In the two subjects whose pregnancies were complicated by severe anemia and triplets and hydramnios, the antipyrine space averaged 41.5 liters (34.8-48.2), the sodium space 22.7 liters (20.4-25.0), and the inulin space 12.5 liters (11.7-13.3). Expressed as percentage

Table III. Volume of Distribution of Antipyrine, Radioactive Sodium, and Inulin in the Puerperium

| SUBJECT | TIME AFTER DELIVERY (DAYS) | WEIGHT (KG.) | VOLUME OF DISTRIBUTION | | | | | | INULIN CLEARANCES (C.C./MIN.) | PLASMA VOLUME T-1824 | | HEMATOCRIT (PER CENT) | INTRACELLULAR FLUID (ANTIPYRINE SPACE-INULIN SPACE) | |
			ANTIPYRINE (L.)	Na²⁴ (L.)	INULIN (L.)	ANTIPYRINE (% BODY WGT.)	Na²⁴ (% BODY WGT.)	INULIN (% BODY WGT.)		ML.	ML./KG.		L.	PER CENT
P. T.*	9	62.8	34	15.97	10.0	54.3	25.4	16	107.4	3,045	48.5	41.7	23.97	38.3
M. N.*	46	68.5	37.48	19.02	14.4	54.7	28	21	71.6	3,388	49.4	41.1	23.07	33.7
A. B.*	12	57	38	18.17	8.3	66.6	31.8	14	67.2	–	–	39.3	29.68	52.6
L. S.	13	61.1	37.5	16.19	6.2	61.2	26.4	10.1	–	2,512	41.1	–	31.25	51.1
A. M.*	16	50.8	32.3	16.36	8.00	63.5	32.09	15.7	86.37	–	–	–	24.28	47.8
A. Mo.	63	71.8	42.4	18.63	10.50	59	26	14.6	94.6	3,096	43.1	–	31.89	44.4
Mean values for P. T., M. N., A. B., A. M. only		59.77	36.9	17.4	9.60	59.8	28.2	15.2		3,010	45.2		27.35	44.6
			35.43	17.38	10.18	59.7	29.3	16.6					25.25	43.1

Table IV. Changes in Weight and in Volume of Distribution of Antipyrine, Radioactive Sodium, and Inulin After Delivery

| SUBJECT | DAYS POST PARTUM | WEIGHT LOSS (KG.) | CHANGE IN VOLUME OF DISTRIBUTION | | | CHANGE IN PLASMA VOLUME (C.C.) | PERCENTAGE OF WEIGHT LOSS REPRESENTED BY TOTAL BODY WATER | CHANGE OF INTRACELLULAR FLUIDS (L.) |
			ANTIPYRINE (L.)	RADIOACTIVE SODIUM (L.)	INULIN (L.)			
P. T.*	9	– 6	– 3.50	–10.5	+0.190	– 122	58.3	–3.68
M. N.*	46	–16.5	–10.0	–13.4	–1.33	–1,520	60.6	–8.58
A. B.*	12	–11.6	– 7.25	– 6.03	+0.97		62.4	–8.21
L. S.	13	– 7.5	– 3.79	– 3.42			50.4	
A. M.*	16	– 8.2	– 4.68	– 2.53	–4.07		57	–0.60
A. Mo.*	63	–12.2	–12.57	– 5.52	–	–1,373	102	
Mean values for 4 patients, P.T., M.N., A.B., A.M.		–10.5	– 6.35	– 8.10	–1.09		59.57	–5.26

*A. Mo. is the only patient who followed a strict salt-free diet since her delivery.

of body weight, these spaces averaged 63.0 per cent, 34.8 per cent, and 19.5 per cent, respectively.

4. *Puerperal Changes.*—The repeat space measurements obtained in six of the seven pre-eclamptic subjects nine to sixty-three days after delivery are presented in Tables III and IV. The average antipyrine, sodium, and inulin spaces equaled 36.9 liters (32.3-42.4), 17.4 liters (16.0-19.0), and 9.57 liters (6.2-14.4); and 59.8 per cent, 28.2 per cent, and 15.2 per cent of body weight, respectively. Compared to the measurements in the pre-eclamptic patients, all but one of the subjects showed a decrease in body weight, antipyrine and sodium space which far exceeded the simultaneous decrease in inulin space (Tables III, IV). The changes averaged −10.5 kg. for body weight, −6.35 liters for the antipyrine space, −8.10 liters for sodium space, and −1.09 liters for the inulin space (Table IV). The decrease in body weight corresponds well with the coincident decrease in antipyrine space but not with the changes in the other indices.

No consistent changes were detected in the glomerular filtration rate in any of the groups studied. The changes in plasma volume during and after pre-eclampsia were similarly unimpressive (Tables I, III).

(Mrs. A. Mo)

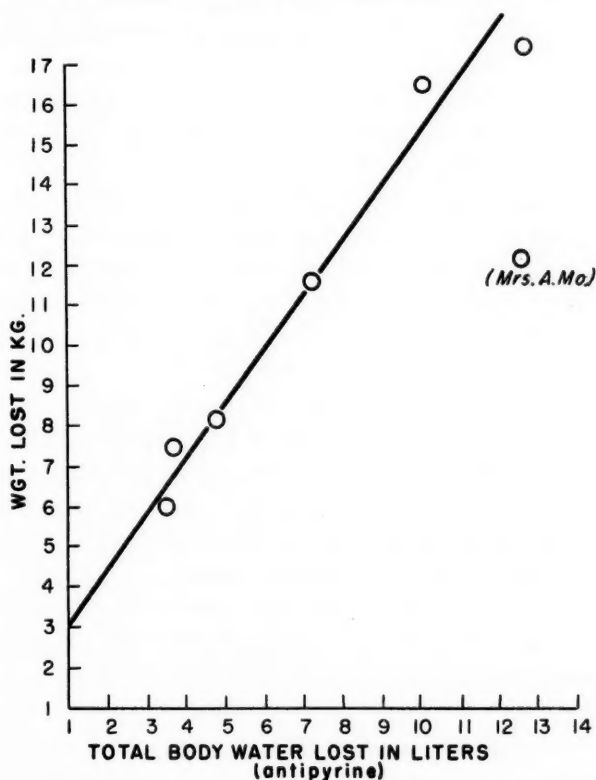Fig. 1.—Relationship between change in weight and total body water after delivery.

Comment

The antipyrine and sodium spaces in pre-eclampsia are significantly larger than similar spaces measured in normal women by others,[10, 25] and ourselves (Tables I, II, III). Indeed, the antipyrine spaces in the pre-eclamptic subjects fall in a range with those recorded in subjects with edema and ascites.[25]

The simultaneous mean inulin space in the seven subjects with pre-eclampsia generally agreed with the mean value described for normal women by others[15, 20, 22] and fell distinctly below the mean volume defined in cardiac patients with edema.[22]

Following delivery and return to normal, repeat measurements revealed a consistent reduction in body weight, antipyrine space, and sodium space, but little change in the inulin space (Tables I, III). A good correlation was noted between the fall in body weight and the reduction in antipyrine space so that little change was detected in the antipyrine space expressed as percentage of body weight (Table III, Fig. 1). The fall in sodium volume, however, exceeded the simultaneous reduction in body weight and antipyrine space, whereas the slight changes in inulin space barely reflected these reductions (Tables I and II and Fig. 1). Similar studies in the two normally pregnant women showed a slight expansion of the inulin space as compared to that in normal subjects, but no striking change in the antipyrine or sodium spaces (Table II). On the other hand, the values determined in the two pathological pregnancies agreed generally with those obtained in the pre-eclamptic subjects (Tables I, II).

The circumstance that inulin does not enter the amniotic sac while antipyrine freely and sodium[24] irregularly permeate this compartment can account for only a small fraction of the difference noted between the spaces in pre-eclampsia and in the puerperium. The total fluid volume in the fetus has been estimated as 1,500 to 2,000 c.c. by Chesley,[33] a figure which approximates one-third of the average 6 liter discrepancy between the change in inulin and antipyrine space. It is similarly unlikely that the skeletal system of the fetus would concentrate sodium to the extent necessary to account for the large falls in sodium space after delivery.

Previous evidence suggests that the volume of antipyrine affords a reliable estimate of total body water.[25] The 5 hour sodium space does not include a significant proportion of slowly exchanging bone sodium. Nevertheless, it is probably safe to assume that serial 5 hour sodium spaces measure comparable proportions of the total body sodium and that significant changes in this sodium space reflect true changes in total body sodium. The volume of distribution of inulin presumably affords a reliable estimate of the volume of the fluid phase of the extracellular compartment. The amniotic sac is not included in this volume but the noncellular fluid contained therein represents only a small fraction of the total extracellular fluid volume. The recent demonstrations of the identity of the sucrose, mannitol, ferrocyanide, and radiosulfate space with the inulin volume[34-37] imply that a finite fluid extracellular volume does exist into which each of these varied molecules may be distributed. It is conceivable that the 5 hour inulin infusion in the preeclamptic subject did not achieve equilibrium distribution, but any significant expansions should be detectable even in the absence of completely homogeneous distribution.[38]

Provided that the indices used in these experiments afford reliable estimates of the total body water, total body sodium, and extracellular fluid vol-

ume, it may be concluded that pre-eclampsia and, possibly, other abnormal pregnancies are characterized by an increased tissue content of sodium and water. These excesses do not appear to be confined in the fluid phase of the extracellular compartment; instead, they are diverted to the more solid phase of the extracellular compartment (i.e., bone) or to certain cellular groups, or possibly to both.

Considerable evidence has accumulated to suggest that sodium retention occurs during the latter part of pregnancy.[5] Direct tissue analysis has revealed significant increases in muscle sodium during pregnancy and enormous increases in eclampsia.[39] Estrogens, estradiol, progesterone, and the corticoid hormones, all of which accelerate the retention of salt, are produced in excessive amounts during pregnancy.[1, 40] The sudden development or disappearance of edema in some patients with eclampsia in the absence of coincident alterations in exogenous electrolyte balance of body weight[41] likewise suggests that sodium and water may be shifted in or out of the fluid extracellular phase. Cortisone, ACTH, and DCA have been shown to effect similar redistributions of sodium, chloride, and water.[38, 42] In dogs treated with adrenal cortical extract, a specific increase in total body water without comparable increase in inulin space has been detected,[42] a finding which is in general agreement with the changes detected in the pre-eclamptic subjects.

These considerations imply that excessive estrogenic and corticoid secretion, via renal and/or extrarenal influences, may be causally related to the increased tissue content of sodium and water which characterizes pre-eclampsia. Whereas it is suggested that similar changes may occur in other pathological pregnancies but not in normal pregnancies, the data obtained in non-eclamptic pregnant women do not permit a definite conclusion in this regard.

Summary and Conclusions

1. Simultaneous inulin, sodium[24], and antipyrine spaces were measured in seven pre-eclamptic subjects before and after delivery, two normal women, two pregnant women without complications, and two subjects with pathological pregnancies.

2. The pre-eclamptic subjects revealed a consistently expanded antipyrine and sodium space but normal inulin space. Sixteen to sixty-three days after delivery significant reductions were noted in the antipyrine and sodium space, but little change was apparent in the inulin space.

3. The two subjects with normal pregnancies revealed a slight increase in inulin space but no striking change in antipyrine or sodium space. The subjects with pathological pregnancies showed changes similar to those obtained in pre-eclampsia.

4. These data suggest that pre-eclampsia, and possibly other abnormal pregnancies, are characterized by increased intracellular penetration of sodium and water.

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BLOOD VOLUME VARIATION DURING LABOR AND EARLY PUERPERIUM*†

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IN RECENT years much interest has centered on the apparent discrepancy between visible and calculated blood loss following delivery.[1-5] These authors are in close agreement that the whole blood loss as determined by several different methods exceeds by far the estimated or measured visible blood loss at the time of delivery. In none of these previous investigations has an attempt been made to measure blood volume changes during the course of labor and the early puerperium.

In this investigation, an attempt has been made to determine the plasma volume variation in normal patients during this particular time interval.

Procedure

Since radioactive isotopes are now unavailable for use in pregnant women for experimental purposes, the less accurate but nonetheless valid method of determining plasma volume trend by means of the dye T-1824 was utilized. The single 10 minute sample method described by Gregerson[6] was used exclusively throughout this investigation. The dye was administered from syringes calibrated to contain a specific volume. The dye concentration in plasma was determined by means of either the Evelyn Photoelectric Colorimeter or the Coleman Junior Spectrophotometer. The accuracy of frequently repeated direct plasma volume determinations on the same individual under basal conditions was studied. As many as four separate determinations were made on a given individual within a period of one hour. The variation between these individual determinations was consistently less than 5 per cent.

Utilizing this method, serial plasma volume determinations were done on normal patients during labor and the early puerperium. Only patients having normal spontaneous deliveries are included in this group. No drugs were administered during labor. If an episiotomy was necessary, a pudendal block with 1 per cent Novocain was done. As many as five separate determinations were done on a given patient within a period of 24 hours. In most instances, three or four determinations were done within a 3 or 4 hour interval. The shortest interval between determinations was 11 minutes. Because of the necessity of obtaining multiple values covering the several hours under study, and because of the limitation of the number of determinations possible on a given patient because of vital staining, certain patients were subjected to multiple determinations during labor, whereas others were studied intensively from delivery throughout the early puerperium. A few patients were subjected to less frequent determinations encompassing the entire study interval. Initial

studies suggested that a rapid increase in plasma volume occurred near the end
of the second stage of labor or during the third stage. For this reason, each
patient in this study had at least one plasma volume determination done within
a 60 minute period, extending from 30 minutes before and 30 minutes after
delivery of the placenta. This interval of 60 minutes has been arbitrarily
designated as the placental phase. Since each determination within this phase
is specifically related to a common factor, namely the time of delivery of the
placenta, it was possible to calculate the average time relationship of all deter-
minations within this phase to the placental time. This average time of deter-
minations was 2.6 minutes prior to the delivery of the placenta.

All determinations done within a 3½ hour interval prior to the placental
phase were similarly averaged with regard to their time relationship to the
placenta. The average time of these determinations was 101 minutes prior to
the delivery of the placenta. A similar time average was calculated for all
determinations done within a 3½ hour interval after the placental phase. The
average time for this group was 81 minutes after delivery of the placenta.

The final time interval included in this study was between 18 and 26 hours
after delivery of the placenta. The mean time for these determinations was 22
hours after delivery of the placenta.

All plasma volumes were expressed in cubic centimeters per pound of body
weight. Because of the wide individual variation in actual plasma volumes,
the individual changes in actual plasma volume between the different time
intervals and the placental phase were averaged.

The second part of this investigation deals with the plasma volume changes
associated with delivery by cesarean section. In order to minimize the effect of
anesthesia on the plasma volume, infiltration anesthesia with 1 per cent Novocain
was used exclusively. Four plasma volume determinations were done on each
individual. The first determination was done approximately one hour prior to
the actual operative procedure. The second was done after the bladder flap
had been reflected off the lower uterine segment and before the uterus had
been opened. The third determination was started immediately before the
uterus was opened and was completed approximately four minutes after the
placenta was removed. The last determination was done approximately one
hour after the placenta had been removed. The operative procedure was com-
pleted in all patients prior to the last determination.

In this cesarean section series, in order to facilitate the injection of the
dye and the withdrawal of the blood samples, a size 16 plastic catheter was
inserted into the antecubital vein and passed upward for a distance of approxi-
mately 14 inches. A control series of determinations using the single catheter
method established its validity.

Results

Spontaneous Delivery.—

Forty-five Negro patients were studied in this series. These patients were
subdivided into three groups. Group A includes those patients in whom plasma
volume determinations were done during labor and during the placental phase.
Group B is comprised of those patients in whom determinations were done dur-
ing the placental phase and within the first 4 hours after delivery. Group C
includes patients from both Group A and Group B who had in addition to the
plasma volume determinations corresponding to their respective groups a final
determination between 16 and 26 hours post partum. Graphic representation
of examples taken from Groups A and B are shown in Figs. 1 and 2, respec-
tively.

The results obtained are shown in Table I.   Group A comprises a total of 28 patients.   Of these, 22, or 78.5 per cent, manifested a mean increase in plasma volume per pound of 3.91 c.c.   In five, or 17.8 per cent, it decreased 2.24 c.c. while in one it remained unchanged.   The mean change for the entire group was
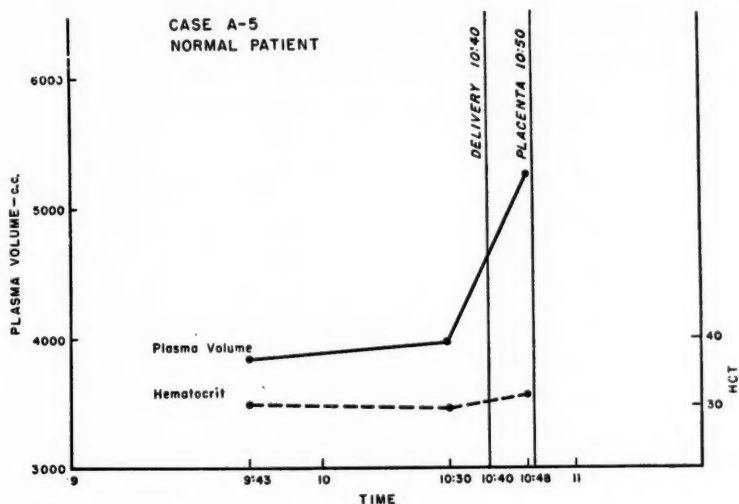
Fig. 1.
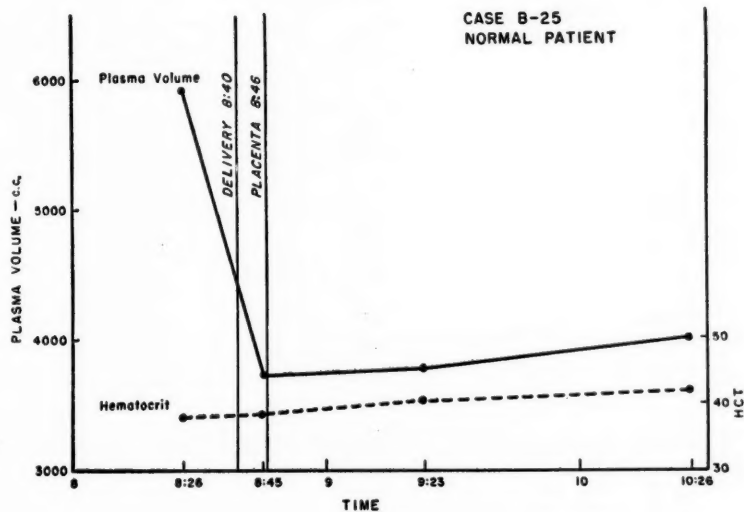
Fig. 2.

an increase of 2.67 c.c. of plasma per pound.   In Group B there were a total of 31 patients.   Twenty-five, or 80.6 per cent, of these manifested a decrease of 3.42 c.c. of plasma per pound.   Six, or 19.4 per cent, showed an increase of 4.5 c.c. of plasma per pound.   The over-all mean change for this group was a decrease of 1.9 c.c. of plasma per pound.

Group C comprised a total of 26 patients.   Eighteen, or 69.2 per cent, of these manifested a decrease of 5.93 c.c. of plasma per pound.   Seven, or 26.9

per cent, showed an increase of 1.95 c.c. of plasma per pound, while in one, or 3.8 per cent, it remained unchanged. The mean change for this group was a decrease of 3.72 c.c. of plasma per pound.

TABLE I. PLASMA VOLUME CHANGE DURING SPONTANEOUS DELIVERY

	NUMBER OF PATIENTS	PLASMA VOLUME CHANGE (C.C./LB.)	
Group A.—			
	22 (78.5%)	+3.91	
	5 (17.8%)	−2.24	Mean +2.67 c.c./lb.
	1 (3.5%)	0	
	28 Total		
Group B.—			
	25 (80.6%)	−3.42	
	6 (19.4%)	+4.5	Mean −1.9 c.c./lb.
	31 Total		
Group C.—			
	18 (69.2%)	−5.93	
	7 (26.9%)	+1.95	Mean −3.72 c.c./lb.
	1 (3.8%)	0.0	
	26 Total		

TABLE II. PLASMA VOLUME CHANGE DURING CESAREAN SECTION (EIGHT PATIENTS)

INTERVAL*	PATIENT	CHANGE (C.C./LB.)	MEAN CHANGE (C.C./LB.)	SIGNIFICANCE
	K. L.	+0.49		
	D. H. (Labor)	−0.72		
	B. J.	−3.47		
1	G. J.	+1.87	−0.16	None
	A. C.	−0.16		
	B. B.	−2.74		
	O. G.	+1.20		
	E. P.	+2.26		
	K. L.	−0.26		
	D. H. (Labor)	−3.98		
	B. J.	+1.65		
2	G. J.	−2.07	−0.84	None
	A. C.	+0.47		
	B. B.	+0.42		
	O. G.	−0.40		
	E. P.	−2.55		
	K. L.	−8.22		
	D. H. (Labor)	No Det.		
	B. J.	−1.97		
3	G. J.	−4.82	−4.0	High
	A. C.	−3.49		
	B. B.	−6.47		
	O. G.	−2.10		
	E. P.	−0.74		

*Interval 1—Initial plasma volume to plasma volume done after the bladder flap was reflected.

Interval 2—Plasma volume at the time of bladder flap reflection to plasma volume done shortly after the placenta was removed.

Interval 3—Placental phase plasma volume to plasma volume approximately one hour post partum.

These changes are represented graphically in Fig. 3. Fourteen of these 45 patients had plasma volume determinations done within all four time intervals under investigation. The mean plasma volume changes between the various time intervals and the placental phase in these 14 patients parallels exactly the trend for the entire group of 45 patients. This finding greatly increases the signifi-

cance of the mean changes manifested by the entire group. The mean plasma volume changes in all groups are statistically significant as determined by the Student "t" test. It should be noted that there was no associated packed cell volume change during the entire study interval.

MEAN PLASMA VOLUME CHANGE
DURING
LABOR, DELIVERY AND PUERPERIUM

Fig. 3.

MEAN PLASMA VOLUME CHANGE
DURING CESARIAN SECTION
LOCAL ANESTHESIA - 8 CASES

Fig. 4.

Delivery by Cesarean Section.—
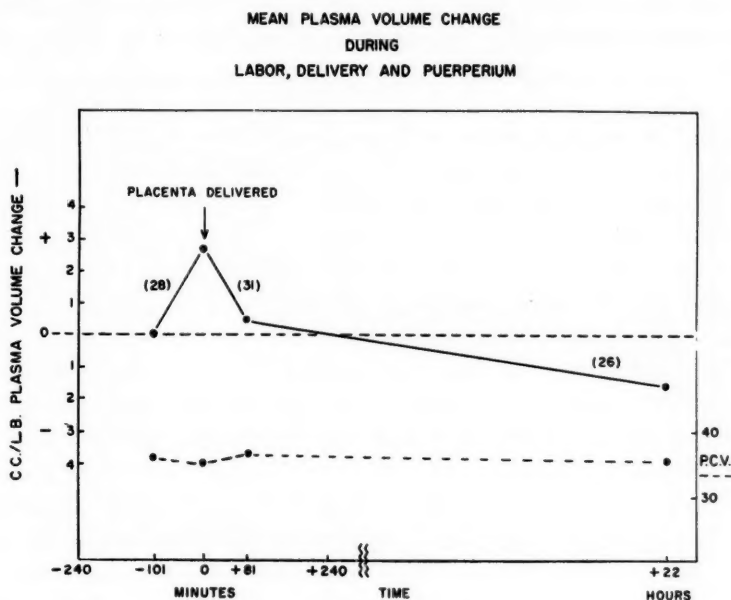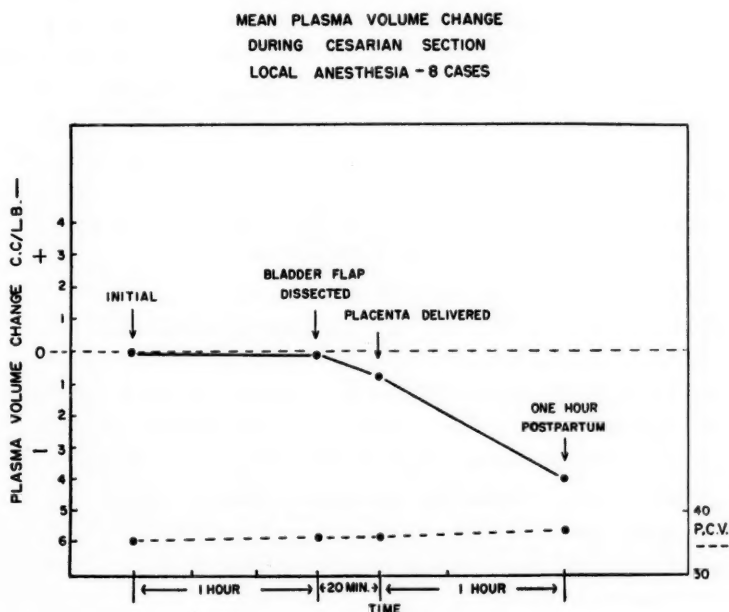Eight patients are included in this series. One of these 8 patients was in active labor (6 cm. dilatation of the cervix). The remaining 7 were not in

TATUM

labor at the time of the cesarean section. These data are seen in Table II and represented graphically in Fig. 4. It is apparent that no significant change in the plasma volume occurred until after the uterus had been emptied. However, within the one hour following removal of the placenta, a mean decrease of 4.0 c.c. of plasma per pound occurred. There was no corresponding change in the packed cell volume throughout the study interval.

Comment

By means of serial plasma volume determinations during labor and the puerperium, a previously unsuspected rise in plasma volume has been demonstrated in the majority of patients studied. This increase in plasma volume manifests itself during the process of normal labor, reaching its peak at approximately the same time as the placenta is delivered. Observations in individual cases have strongly suggested that the rise in plasma volume may be quite abrupt, appearing within an interval of less than 10 minutes. Because of the obvious inadequacy of the dye method for detecting changes occurring within a period of less than 10 minutes, no attempt has been made to delineate more accurately the exact time at which this rise begins nor at which exact time the maximum peak is reached. For this same reason, the maximum amplitude of the rise has not been ascertained. It has, however, become apparent that the rise begins late in labor, and that a significant increase in plasma volume has appeared by the time the placenta has been spontaneously delivered. In 22 of the 28 patients, this rise in plasma volume averaged 3.9 c.c. per pound. For an average patient weighing 150 pounds, this increase amounts to 585 c.c. of plasma, which, on the basis of whole blood having a packed cell volume of 35, amounts to 900 c.c. Within 2 hours following delivery of the placenta, there has occurred a similarly abrupt decrease in plasma volume. On the basis of certain individual observations, this decrease has been observed to occur within a 10 minute interval. Again, the limitations of the method have prevented more accurate determinations of the exact rate of the decrease. The magnitude of the plasma volume decrease occurring within this 2 hour interval in 80 per cent of the patients was found to be 3.5 c.c. per pound. On an average of 22 hours after delivery, the mean decrease in plasma volume in the 69 per cent of the patients who showed a decrease during this interval was 5.9 c.c. per pound. Calculated on the basis of whole blood having a packed cell volume of 35, this would amount to a decrease of 1,320 c.c. This is in good agreement with the blood loss as reported by others.[1-5] The mean decrease in plasma volume of all patients studied during this time interval was 3.7 c.c. per pound, or an estimated 854 c.c. of whole blood. Since the change in plasma volume occurs with such rapidity, it is quite possible that the discrepancies reported in Table I are the result of improper timing of the determinations rather than actual variations in the plasma volume change.

It should be emphasized here that there was no significant change in the packed cell volume throughout the entire study interval. In the absence of any associated change in packed cell volume, it must be assumed that the increase and subsequent decrease in plasma volume, which was observed in the majority

of patients, can be explained only by shifts in whole blood first into and then later away from the actively circulating blood column. If the sudden increase in whole blood comes from the contracted uterus at the end of the third stage, one would be obliged to assume that, prior to its emptying, the uterus contained a large amount of blood with relatively undyed plasma. This would infer relative stagnation of blood within the uterus. There is no evidence at the present time that such stagnation occurs. Other possible sources of this mass of whole blood are being sought at the present time. The cause of this sudden increase in blood volume at the time of delivery is at the present time unknown. There remains a remote possibility that some physiologic or mechanical alteration occurs at the time of delivery, which completely invalidates the use of the dye method during this particular interval.

The effect of labor itself on the blood volume is difficult to evaluate. The question immediately presents itself as to what happens to the blood volume at the time the uterus is emptied by cesarean section in the absence of labor. The study of 8 patients during cesarean section has demonstrated that emptying of the uterus per se does not produce any significant increase in the plasma or blood volume. Although one of the 8 patients was in moderate labor at the time of cesarean section, no difference in plasma volume trend was demonstrated. In order properly to complete this series, however, a similar study should be made on a number of patients who have progressed spontaneously through the first stage of labor but who are unable to deliver spontaneously because of cephalopelvic disproportion. Such patients, however, are encountered infrequently. Such observations would tend to indicate more clearly the actual effect of labor itself on plasma volume. The possibility cannot be excluded that an increase in blood volume at the time of uterine emptying by cesearean section may be prevented by some neurogenic or physical factors brought about by an open abdomen. However, during the 1 hour period following the removal of the placenta, a very significant decrease in blood volume occurs. This decrease in whole blood amounts to approximately 923 c.c., which is at least twice the visually estimated blood loss occurring during the operative procedure in these eight cases.

Lowenstein and associates[7] have demonstrated that in all probability the puerperal uterus does not contain enough blood to account for this calculated decrease. A satisfactory explanation is lacking at the present time.

The possible clinical significance of the sudden increase in blood volume at the time of normal delivery warrants consideration. It is well recognized clinically that the pregnant cardiac patient experiences her first real functional test between the twenty-second and thirtieth weeks of pregnancy. This period carries the highest cardiac mortality incidence of the prenatal period. The accepted explanation for this is that the plasma volume has rather rapidly increased during this time interval, thus exerting a marked increase in the cardiac load. The second important functional test occurs during the relatively short period from the end of the second stage of labor through the first 1 to 2 hours of the puerperium.[8]

The possible correlation between this second critical period and plasma volume changes has not been suspected prior to this time, since all previously published data have indicated that the plasma volume gradually decreases from the thirty-sixth week of pregnancy until it reaches the normal nonpregnant level some time during or after the first postpartum week.

An apparent parallelism seems to exist between the maternal cardiac death rate and plasma volume levels or the rate of increase of plasma volume. Other important factors during labor, such as increased pulse rate, blood pressure, excitement, and actual work involved, in addition to the abrupt decrease in vital capacity which occurs immediately after delivery, contribute to the high incidence of cardiac deaths occurring during this critical period. An interesting question may be raised at this time. Would a phlebotomy be indicated shortly before delivery in a patient having a very limited cardiac reserve? The next question which might arise is that if there is no sudden rise in blood volume following delivery by cesarean section as compared to spontaneous delivery, why do cardiac patients tolerate cesarean sections so poorly? The only plausible answer to this last question is that the operative trauma associated with cesarean section inflicts a greater load on the heart than does the very transient increase in blood volume incident to a normal delivery.

Conclusions

1. Serial plasma volume determinations were done at frequent intervals on 45 normal patients during labor and the early puerperium.

2. The data indicate that, in the majority of patients studied, a transient but significant rise in plasma volume occurred at or near the end of normal labor.

3. Within two hours after delivery, the plasma volume decreased in the majority of patients to a level lower than has been reported for any time during the last half of pregnancy.

4. The increase in plasma volume is apparently produced by a sudden release of pooled whole blood into the active circulation.

5. The subsequent decrease in plasma volume is apparently caused by the removal from active circulation of a mass of whole blood.

6. No significant increase in plasma volume was demonstrated in patients delivered by cesarean section.

7. Cesarean section was followed in all cases by a significant decrease in plasma volume.

8. A correlation between the plasma volume increase occurring at the end of labor and the maternal cardiac death incidence at this time has been suggested.

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THE INFANT MORTALITY IN SPECIFIC HYPERTENSIVE DISEASE OF PREGNANCY AND IN ESSENTIAL HYPERTENSION

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THE infant mortality in pregnancies complicated by specific hypertensive disease (pre-eclampsia and eclampsia) and the factors affecting it have been described previously.[1] The present report compares that mortality with the infant loss occurring in essential hypertension antedating pregnancy.

Material

The hypertensive patients were observed in the obstetrical department of Bellevue Hospital among the patients delivered during a 15 year period ending May 31, 1950.

Classification of the Hypertensive Conditions Complicating Pregnancy

Pregnancies complicated by hypertension were grouped according to the following classification which was reported previously.[2,3]

1. Specific hypertensive disease of pregnancy
   a. Without convulsions (pre-eclampsia)
   b. With convulsions (eclampsia)
2. Essential hypertension (pre-existing)
3. Glomerulonephritis (pre-existing or initial attack)
4. Specific hypertensive disease of pregnancy superimposed on:
   a. Essential hypertension (pre-existing)
   b. Glomerulonephritis (pre-existing or initial attack)
5. Unclassified

The unclassified group did not represent a separate disease entity. The patients were identified as such because sufficient data were not available either in early pregnancy, during the course of the condition, or in the follow-up period. Some had no prenatal observation. Others applied for care in late pregnancy with hypertension and associated symptoms well established. Patients sent to Bellevue Hospital by other clinics, hospitals, or private physicians without adequate information were included in this group. Occasionally patients without care in early pregnancy left the hospital after delivery with proteinuria and/or hypertension and did not seek follow-up observation at a special nephritis and hypertension clinic.

Incidence of the Hypertensive Conditions Complicating Pregnancy

There were 27,028 patients delivered during the 15 years of this report. Among these, 1,268 had 1,400 pregnancies complicated by some hypertensive condition, an incidence of 5.17 per cent (Table I).   Fig. 1 shows that specific hypertensive disease, commonly known as pre-eclampsia and eclampsia, was encountered most frequently.   The 1,010 cases in this group made up 72 per cent of the hypertensive patients.   Essential hypertension antedating pregnancy was next in frequency.   The 278 cases in this group produced almost 20 per cent of the total.   Eighty-three, or 30 per cent, of these developed specific hypertensive disease.   Glomerulonephritis was least frequent, with 23 cases, an incidence of 1½ per cent.   Eighty-nine, or 6.3 per cent, of the cases could not be classified.

DISTRIBUTION OF THE HYPERTENSIVE CONDITIONS
COMPLICATING 1,400 PREGNANCIES

	SPECIFIC HYPERTENSIVE DISEASE	ESSENTIAL HYPERTENSION UNCOMPLICATED	ESSENTIAL HYPERTENSION PLUS S.H.D.P.*	GLOMERULO-NEPHRITIS	UNCLASSIFIED
NO. PATIENTS	939	156	68	17	85
NO. PREGNANCIES	1,010	195	83	23	89
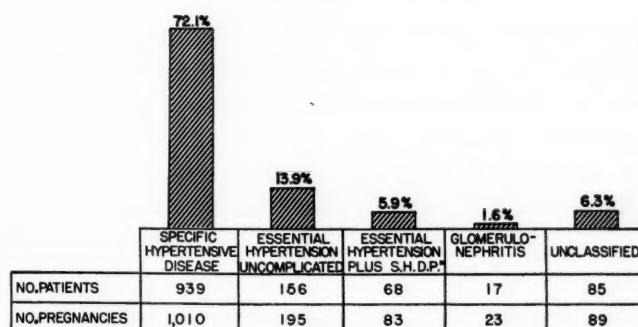
*S.H.D.P. - SPECIFIC HYPERTENSIVE DISEASE OF PREGNANCY

Fig. 1.

TABLE I.   INCIDENCE OF HYPERTENSIVE CONDITIONS COMPLICATING PREGNANCY AT BELLEVUE HOSPITAL, 15 YEARS

TOTAL DELIVERIES 1936-1950	HYPERTENSIVE CONDITIONS OF PREGNANCY		
	NUMBER PATIENTS	NUMBER PREGNANCIES	INCIDENCE PER CENT
27,028	1,268	1,400	5.17

Management of Patients

The antepartum observations, treatment, and indications for and methods of termination of pregnancies in patients with specific hypertensive disease have been previously reported.[1]

Patients with pre-existing essential hypertension attended a special antepartum clinic at frequent intervals.

Hospital care was advised for various indications: (1) to obtain supervised periodic bed rest during pregnancy, especially at or near term, (2) when the hypertensive state became progressive, or (3) when severe specific hypertensive disease set in.

Forty-six of the 278 patients with pre-existing essential hypertension had not attended the Bellevue Hospital prenatal clinic and were first seen in active labor. One hundred patients did not require any hospital antepartum care. One hundred twenty-three had from 1 to 3 antepartum admissions. Nine refused hospital care. Antepartum hospital admission prior to delivery was considered an important preventive measure in other than the mildest cases. These stays varied from 2 to 50 days. In the uncomplicated cases, 53 patients received such observation. Forty-five of the 83 women who developed added specific disease had a final antepartum hospital stay.

Treatment was symptomatic. Pregnancies were terminated: when the hypertensive state progressed in spite of treatment; in cases with severe superimposed specific disease too far from term to be carried with safety; in those patients showing evidence of threatening eclampsia; and, finally, in cases in which marked fundus oculi changes set in.

Infant Mortality in Specific Hypertensive Disease of Pregnancy and in Essential Hypertension

The infant mortality (stillbirths and neonatal deaths) was increased in pregnancies complicated by these two hypertensive conditions.

Fig. 2 shows that the infant loss was greater in essential hypertension than in specific hypertensive disease. The mortality was 2½ times as great in the latter condition and 3 times as great in the former when compared with the loss sustained in the group of nonhypertensive patients.

The severity of the hypertensive conditions affected the infant's chance for survival. In mild specific disease the loss was only slightly higher than that in the nonhypertensive group. When this condition became severe, the mortality was increased 4 times. The loss in uncomplicated essential hypertension was double that in the total number of patients delivered. It was increased almost 5½ times when specific disease developed.

Corrected Incidence of Stillbirths in Specific Hypertensive Disease and in Essential Hypertension

Sudden intrauterine deaths occur when these hypertensive conditions complicate pregnancy. The infant's loss was assumed to be due to the hypertensive state after deaths due to abnormal fetus, erythroblastosis, prolapsed cord, and obstetrical trauma were ruled out.

The severity of the hypertensive state influenced the corrected incidence of stillbirths. Fig. 3 shows that the incidence of stillbirth was 3.1 per cent in mild specific disease. In the severe cases the loss was increased 5 times. The loss was 6.5 per cent in uncomplicated essential hypertension. It increased 2½ times when specific hypertensive disease set in. (The corrected stillbirth incidence in the nonhypertensive group was not determined.)

The autopsies on the stillborn infants were reviewed. Seventy-one and seven-tenths per cent of the 106 stillborn infants were autopsied. The findings were the same in the groups with specific hypertension and essential hyper-

tension. Forty-five per cent showed extreme degrees of maceration and autolysis, these changes preventing any informative observations. In the remaining 55 per cent the findings were more revealing, since the autopsies were performed on the fetuses that had died shortly before labor and delivery. Asphyxia, as evidenced by petechial hemorrhages and congestion of lungs, brain, and other viscera, was the chief finding. It is believed that these intrauterine deaths are due to oxygen deprivation.[4] The causes of the anoxia are not known.

INFANT MORTALITY IN SPECIFIC HYPERTENSIVE DISEASE
OF PREGNANCY, AND IN ESSENTIAL HYPERTENSION

	TOTAL DELIVERIES 15 YEARS	SPECIFIC HYPERTENSIVE DISEASE OF PREGNANCY			ESSENTIAL HYPERTENSION		
		TOTAL	MILD	SEVERE	TOTAL	UNCOMPLICATED	ESSENTIAL HYPER. PLUS S.H.D.P.
NO. INFANTS	27,274	1,040	674	366	281	198	83
INFANT DEATHS	1,407	129	48	81	43	20	23

Percentages shown on bars: 5.2%, 12.4%, 7.1%, 22%, 15.3%, 10.1%, 27.7%
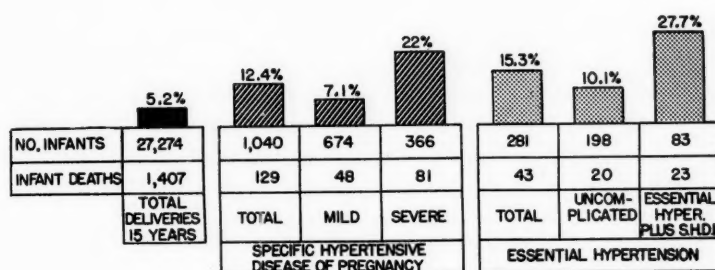
Fig. 2.

CORRECTED INCIDENCE OF STILLBIRTH IN SPECIFIC HYPERTENSIVE
DISEASE OF PREGNANCY, AND IN ESSENTIAL HYPERTENSION

	MILD S.H.D.P.	SEVERE S.H.D.P.	ESSENTIAL HYPERTENSION	ESSENTIAL HYPT PLUS . S.H.D.P.
NO. INFANTS	674	366	198	83
NO. STILLBORN INFANTS	21	58	13	14

Percentages shown on bars: 3.1%, 15.8%, 6.5%, 16.8%

Fig. 3.

Factors Affecting Infant Mortality

Some of the chief factors contributing to the infant mortality were reviewed. They were:

Development of Eclampsia.—
There were 54 cases of eclampsia in the group of 1,010 cases of specific hypertension, an incidence of 5.3 per cent. The majority were nonclinic pa-

tients who had active convulsive seizures prior to hospital admission or shortly thereafter.

The infant mortality increased precipitately when eclampsia supervened in a pregnancy complicated by pre-eclampsia. Twenty-three of the 58 infants of the patients with eclampsia were lost, a 39 per cent mortality. This was 3½ times greater than the loss sustained in the nonconvulsive group. Nine hundred eighty-two infants were born to the latter. The 106 which were either stillborn or did not survive the neonatal period produced a loss of 10.7 per cent.

Eclampsia did not affect the infant mortality in the group with essential hypertension because of its infrequent occurrence. Only two patients had convulsive seizures. One infant was lost. This is a lower incidence of eclampsia than that reported by Chesley[11] and by Brown.[12] They independently found an incidence around 11 per cent. It is probable that our lower occurrence was accounted for by the frequent observations of the essential hypertensive patients in a special clinic and their immediate hospital admission when any significant degree of specific disease developed. Added to this was rigid adherence to the indications for termination of pregnancy mentioned previously.

INCIDENCE OF PREMATURE SEPARATION OF PLACENTA IN SPECIFIC HYPERTENSIVE DISEASE OF PREGNANCY, AND IN ESSENTIAL HYPERTENSION
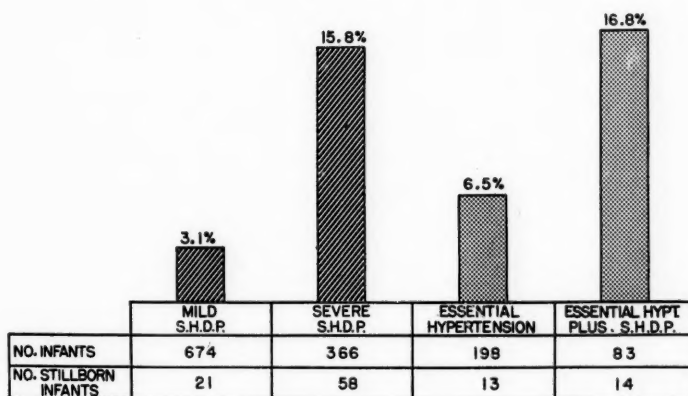
	TOTAL DELIVERIES 15 YEARS	SPECIFIC HYPERTENSIVE DISEASE OF PREGNANCY			ESSENTIAL HYPERTENSION		
		TOTAL	MILD	SEVERE	TOTAL	UNCOM-PLICATED	ESSENTIAL HYPER. PLUS S.H.D.P.
NO. PATIENTS	27,028	1,010	657	353	278	195	83
PREMATURE SEPARATION	326	29	10	19	7	2	5
%	1.2%	2.8%	1.5%	5.3%	2.5%	1.0%	6.0%
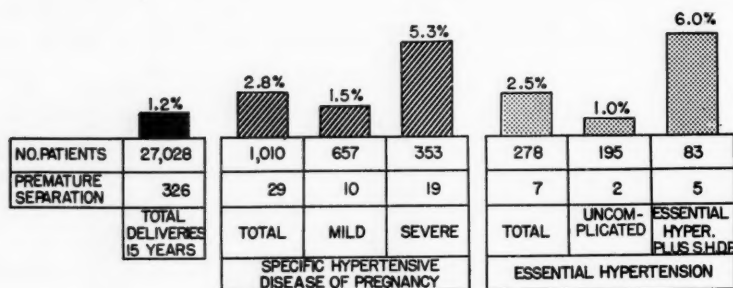
Fig. 4.

Premature Separation of the Normally Implanted Placenta.—

We stated in a previous report, "The cause of premature separation of the placenta cannot often be determined. Observers[5, 6, 7] are in accord that a large percentage have an associated hypertensive condition."

There was a close similarity in the incidence of placental separation in specific hypertensive disease and in essential hypertension. Fig. 4 shows that among the nonhypertensive patients, its incidence was 1.2 per cent. The increase to 2.8 per cent in specific hypertensive disease was almost identical with that in essential hypertension, namely, 2.5 per cent.

The severity of the hypertensive state influenced the occurrence of placental separation. Its development was unaltered by mild specific disease or uncomplicated essential hypertension where it was similar to the incidence in

nonhypertensive patients. However, a definite rise to 5.3 per cent occurred in the group with severe specific disease and to 6 per cent in those with essential hypertension who developed an added pre-eclampsia.

Premature separation of the placenta affected the infant mortality. Twenty-six infants died out of the 29 born to patients with premature separation in the specific hypertension group. These deaths made up 20 per cent of the 129 infants lost in the latter condition. No infant survived in the 7 cases which occurred in the group with essential hypertension. These deaths made up 16 per cent of the 43 infant deaths in the latter condition.

Labor and Delivery.—

The relation of infant mortality to the management of labor and delivery in specific hypertensive disease has also been reported previously.[1] The same principles of management were followed in the patients with essential hypertension. These were: the administration of minimal amounts of analgesic drugs and the use of the low forceps and/or episiotomy[8] in premature births; pudendal nerve block for vaginal delivery; and, finally, the avoidance of inhalation anesthesia in cesarean section.

INCIDENCE OF CESAREAN SECTION IN SPECIFIC HYPERTENSIVE DISEASE
OF PREGNANCY, AND IN ESSENTIAL HYPERTENSION

	TOTAL DELIVERIES 15 YEARS	SPECIFIC HYPERTENSIVE DISEASE OF PREG.	ESSENTIAL HYPERTENSION
NO. PATIENTS	27,028	1,010	278
NO. SECTIONS	752	63	24
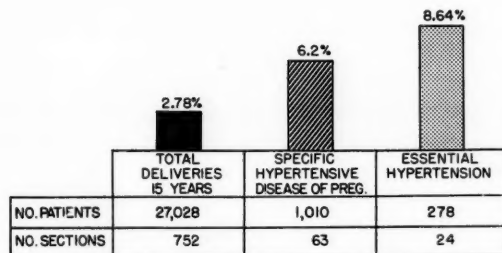
Fig. 5.

The incidence of cesarean section was increased in the hypertensive conditions. Fig. 5 shows that the section rate was approximately 2½ times as great in the group with specific disease as in the nonhypertension group. In a large measure these sections were performed for severe premature separation of the placenta or for threatening eclampsia. The section rate was even higher in essential hypertension. It was 3 times as frequent in this condition as in the total group of patients delivered. Only one of the 9 sections in the patients with uncomplicated essential hypertension was done for the hypertensive condition. On the other hand, 15 sections were performed when specific hypertensive disease set in. Because of the severity of the condition 10 of these were done to lessen the hazards to the mothers. Thus the increased number of sections in essential hypertension was accounted for to a large degree by the added specific hypertensive disease.

Tubal ligation was considered indicated in: (1) patients who had repeated pregnancies complicated by the hypertensive conditions; (2) advanced hyper-

tensive disease antedating a last pregnancy; and (3) multiparous women with
essential hypertension who developed very severe specific hypertensive disease.
Tubal ligation was performed at the time of cesarean section or in the early
nonmorbid postpartum period in patients who delivered per vaginam.

The incidence of tubal ligation was higher after pregnancies complicated
by pre-existing essential hypertension. Fig. 6 shows that there was no increase

INCIDENCE OF TUBAL LIGATION IN SPECIFIC HYPERTENSIVE DISEASE OF
PREGNANCY, AND IN ESSENTIAL HYPERTENSION
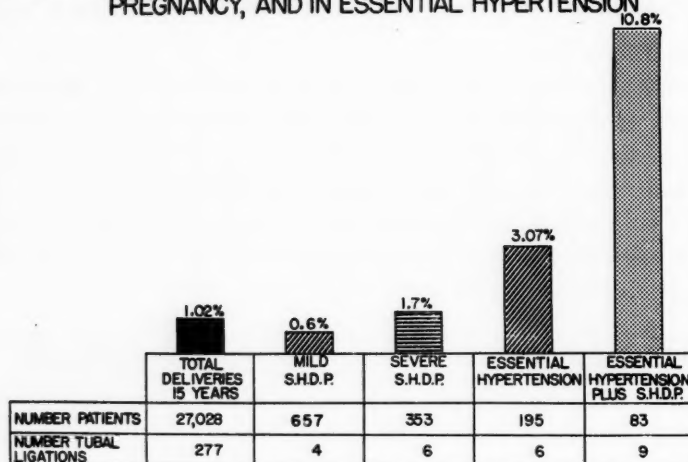
	TOTAL DELIVERIES 15 YEARS	MILD S.H.D.P.	SEVERE S.H.D.P.	ESSENTIAL HYPERTENSION	ESSENTIAL HYPERTENSION PLUS S.H.D.P.
	1.02%	0.6%	1.7%	3.07%	10.8%
NUMBER PATIENTS	27,028	657	353	195	83
NUMBER TUBAL LIGATIONS	277	4	6	6	9

Fig. 6.

INCIDENCE OF PREMATURITY IN SPECIFIC HYPERTENSIVE
DISEASE OF PREGNANCY, AND IN ESSENTIAL HYPERTENSION

		SPECIFIC HYPERTENSIVE DISEASE OF PREGNANCY			ESSENTIAL HYPERTENSION		
			16.9%	10.4%	28.9%	17%	11.1%	31.3%
NO. INFANTS	27,274	1,040	674	366	281	198	83
NUMBER PREMATURES	2,845	176	70	106	48	22	26
	TOTAL DELIVERIES 15 YEARS	TOTAL	MILD	SEVERE	TOTAL	UNCOMPLICATED	ESSENTIAL HYPER. PLUS S.H.D.P.
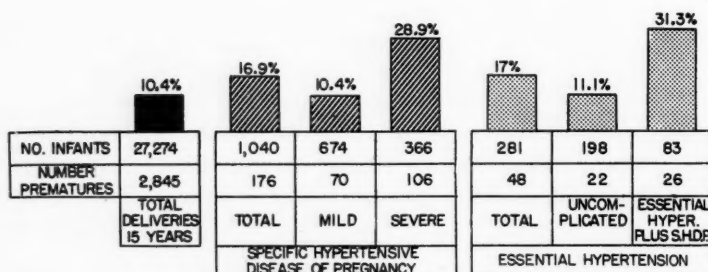
Fig. 7.

in specific hypertensive disease. When compared with the nonhypertension
group, tubal ligation was performed 3 times as frequently in uncomplicated
essential hypertension and 10 times as often when specific disease developed.

Prematurity.—

The incidence of prematurity was increased in the hypertensive conditions
complicating pregnancy. (Infants who weighed up to 5 pounds were con-
sidered premature.) Fig. 7 shows that its occurrence was identical in specific
hypertensive disease and in essential hypertension, namely, 17 per cent. This
was about 6½ per cent greater than in the total group of patients delivered.

The severity of the hypertensive state affected the occurrence of prematurity. Mild specific disease or uncomplicated essential hypertension did not cause any increase. In these conditions the incidence was similar to that in the nonhypertension group. On the other hand, the increased incidence of prematurity was accounted for by the sharp rise in the group with severe specific disease and in those patients with essential hypertension who developed added specific disease.

CAUSES OF PREMATURE DELIVERY IN SPECIFIC HYPERTENSIVE DISEASE
OF PREGNANCY IN ESSENTIAL HYPERTENSION

NO. PREMATURE INFANTS	115	30	26	11	16	5	19	2
	UNKNOWN SPONTANEOUS LABOR		INDUCED LABOR OR CESAREAN SECTION		PREMATURE SEPARATION OF PLACENTA		TWINS	

65.3%   62.5%   14.8%   22.9%   9.1%   10.4%   10.8%   4.1%

PRE-EXISTING ESSENTIAL HYPERTENSION (48 INFANTS)

SPECIFIC HYPERTENSIVE DISEASE OF PREGNANCY (176 INFANTS)
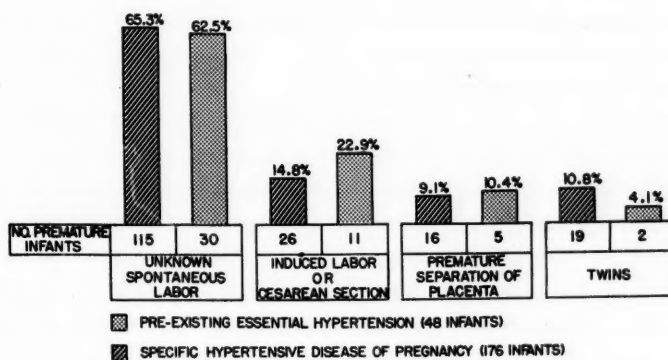
Fig. 8.

NEONATAL MORTALITY OF PREMATURE INFANTS IN SPECIFIC
HYPERTENSIVE DISEASE OF PREGNANCY AND ESSENTIAL HYPERTENSION

100%   62%   45%   43%   10%   12%   7%

WEIGHT LBS-OZS	1-1¹⁵	2-2⁷	2⁸-2¹⁵	3-3⁷	3⁸-3¹⁵	4-4⁷	4⁸-4¹⁵
LIVE PREMATURES	6	8	11	16	20	41	42
NEONATAL DEATHS-33	6	5	5	7	2	5	3
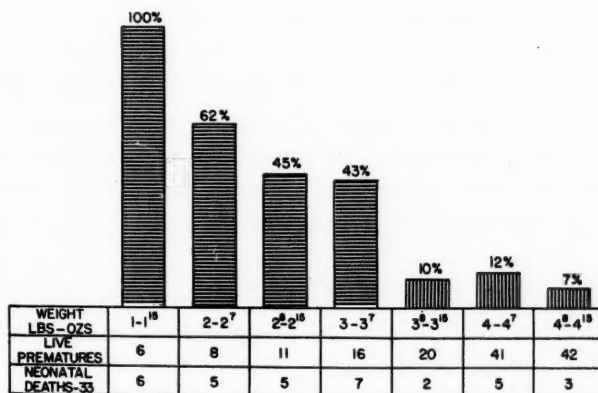
Fig. 9.

Causes of Prematurity.—

The chief causes of prematurity were analyzed. Fig. 8 shows that about two-thirds of the premature labors developed spontaneously for unknown reasons. The incidence was almost the same in specific hypertensive disease, 65.3 per cent, and in essential hypertension, 62.5 per cent.

In order to lessen the hazards to mother and/or infant, artificial termination of pregnancy was accomplished either by induction of labor or cesarean

section. This produced the next highest incidence of prematurity, almost 15 per cent in the specific group and 23 per cent in the essential hypertension group. In the former termination was accomplished equally by induction of labor or cesarean section. The sharp increase in the latter group occurred exclusively in patients who had developed specific disease and all terminations were by cesarean section.

Premature separation of the placenta contributed to the incidence of prematurity at an almost identical level in both hypertensive conditions, 9.1 per cent and 10.4 per cent, respectively.

Multiple pregnancies added to the occurrence of prematurity in specific hypertensive disease. Twin pregnancies produced 10.8 per cent of the prematures in the latter group of cases. This occurred because of the high incidence of this condition in twin pregnancies. Multiple pregnancies were not a factor in the essential hypertension group.

One hundred forty-four premature infants were born alive. They were transferred to the pediatric service. Twenty-seven succumbed within the first 48 hours of life and 6 died in the neonatal period. The high loss in the early hours of life is commonly reported by other investigators.[9, 10]

The weight of the infant influenced the chance for survival in the neonatal period. Fig. 9 shows that no infant of less than 2 pounds survived. The average loss was 50 per cent from 2 to 3½ pounds, and 10 per cent from 3½ to 5 pounds.

Summary

During a 15 year period ending May, 1950, 27,028 patients were delivered in the Obstetrical Department of Bellevue Hospital. Fourteen hundred of these were complicated by some hypertensive condition. This produced an incidence of hypertension of 5.1 per cent.

The hypertensive patients were grouped in accordance with a classification previously reported. The type and incidence of these hypertensive conditions were: specific hypertensive disease (pre-eclampsia and eclampsia) 72 per cent; essential hypertension antedating pregnancy 20.8 per cent; glomerulonephritis 1.6 per cent; and unclassified 6.3 per cent. Thirty per cent of the patients with essential hypertension developed specific hypertensive disease.

The infant mortality (stillbirths and neonatal deaths) in specific hypertensive disease was compared with that occurring in essential hypertension. It was 2½ times as great in the former condition and 3 times as great in the latter when compared with the loss sustained in the nonhypertension group.

The severity of the hypertensive condition influenced the infant mortality. The loss in mild specific disease was only slightly above that in the nonhypertension group. However, it was 4 times as great in the severe cases. The infant mortality in uncomplicated essential hypertension was double that in nonhypertension, but it was increased 5 times when specific hypertensive disease developed. A similar pattern of the effect of severity of disease was noted in the corrected incidence of stillbirths. Intrauterine deaths were assumed to be due to the hypertensive condition after fetal abnormalities,

erythroblastosis, prolapsed cord, and obstetrical trauma were ruled out.

These losses were greater in severe specific disease than in the mild cases and in essential hypertension with pre-eclampsia or eclampsia. Fetal autopsies revealed either extreme degrees of maceration and/or autolysis or evidence of asphyxia. The incidence of premature separation of the placenta and prematurity was increased when the hypertensive state was severe. These conditions in turn affected the infant mortality.

The development of eclampsia in the group with specific hypertension produced an infant loss 3½ times greater than that occurring in patients without convulsions. Among the essential hypertensive patients, only 2 developed convulsive seizures and thus did not influence the infant mortality. This low incidence was attributed to a policy of regular and frequent hospital admissions during the antepartum period in other than the mild cases. Added to this was the rigid adherence to the indications for artificial termination of pregnancy.

The cesarean section rate was increased. It was approximately 2½ times as great in specific hypertensive disease and 3 times as frequent in essential hypertension as in the nonhypertension group. In the former, the sections were performed in a large measure for premature separation of the placenta and for threatening eclampsia. In the latter they were chiefly done to lessen the hazards to the mother because of the added specific hypertension.

The incidence of tubal ligation was markedly increased in the patients with essential hypertension and unaltered in the group with specific hypertensive disease.

The occurrence of premature separation of the placenta and the incidence of prematurity were increased by both hypertensive conditions. Their onset was not influenced by mild specific hypertensive disease and uncomplicated essential hypertension. On the other hand, the increased occurrence developed in the group with severe specific disease and in those with essential hypertension who developed pre-eclampsia. Almost all of the infants were lost in the cases of placental separation. Eighty per cent of the prematures that succumbed in the neonatal period did so within the first 48 hours of life. The increased weight of the live premature infant favorably influenced his chance for survival.

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THE EFFECT OF MATERNAL TOXEMIA ON FETAL GONADAL ACTIVITY

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THE observation that the toxemias of pregnancy are associated with an increased level of gonadotrophin excretion has been repeatedly advanced in recent years.[1-8] That the gonadotrophins cross the placenta from the maternal to the fetal circulation is also generally accepted.[3, 4, 9] Taken together, these two observations would mean that the gonads of the intrauterine baby of a toxemic woman are subjected to a greater stimulation than are the gonads of the baby of a nontoxemic woman. The present report examines this conclusion from the point of view of the autopsy material available from the stillbirths and neonatal deaths of babies resulting from pre-eclamptic and eclamptic pregnancies.

Normally, at the time of birth, the fetal gonads are relatively inactive. The ovaries consist of many primordial follicles in close proximity to one another, separated by a small amount of dense cellular stroma. The testes are composed primarily of multiple compact tubules surrounded by scattered mesenchymal cells and a few interstitial cells of Leydig. Govan,[10] in his preliminary observations, made the first systematic study of the fetal ovary in infants of toxemic and nontoxemic mothers. He reported consistent findings of maturation, cystic atresia, and luteinization in the fetal ovaries of babies from his toxemic group of mothers. No systematic study of the effect of maternal toxemia on the fetal testis has yet been reported in the literature.

Method

The autopsy records on stillborn children and those who died in the neonatal period were reviewed for the past two years (January, 1950, to September, 1952). Routine autopsy slides, stained with hematoxylin and eosin, of the ovaries and testes of these babies were studied. These microscopic slides were categorized into two main groups after the mothers' charts were carefully reviewed. Group A was composed of the fetal gonads from nontoxemic mothers while in group B were the fetal gonads from the toxemic mothers. No selection was made as to whether these were premature or full-term babies.

The following criteria were established as characterizing a normal gonad:

Ovary.—The normal fetal ovary is composed of numerous primordial follicles that are separated by a dense cellular stroma in which insignificant capillaries are seen. In the deeper layers of the ovary it is not uncommon to see primordial ova surrounded by layers of deeply stained cuboidal cells. This

was considered normal as long as the granulosa layer did not exceed two layers of cells, and the perivitelline space and the total size of the follicle were small. Beyond this, changes were considered as evidence of maturation.

Testis.—The normal fetal testis consists of many compact cellular tubules filled with round dark-stained cells which are surrounded by a basement membrane. Beneath the basement membrane and between the tubules in the interstitial spaces are capillaries, fibroblasts, macrophages, mesenchymal cells, and the interstitial cells of Leydig. The latter cells are arranged in groups, have large nuclei with one or more nucleoli, and an abundant cytoplasm. Deviations from normal were based on Leydig-cell hyperplasia with an associated capillary proliferation and engorgement.
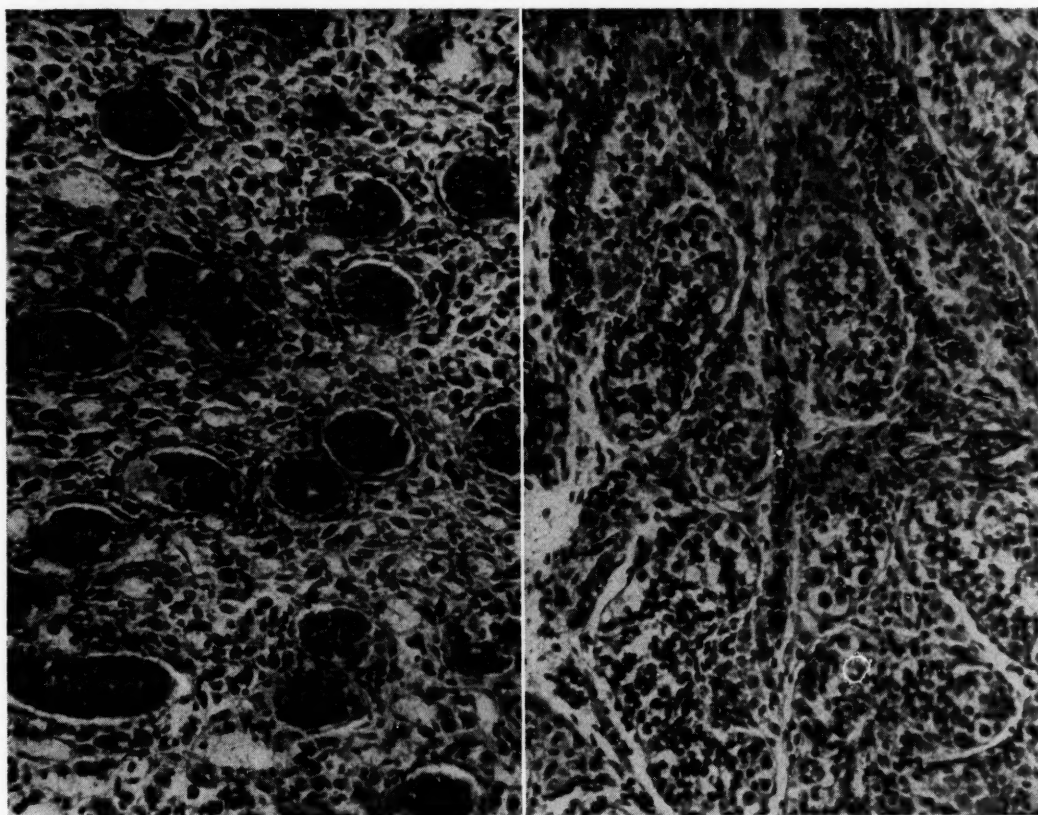
Fig. 1.   Fig. 2.

Fig. 1.—Fetal testis showing marked Leydig-cell hyperplasia (Group III).
Fig. 2.—Normal fetal testis.

Observations.—The nontoxemic group was composed of 32 babies, 12 of whom were females and 20 males. In seven of the 12 babies the ovaries showed no signs of follicular maturation and consisted almost entirely of primordial ova. The 5 cases that were not normal showed various degrees of follicular maturation ranging from very early maturation in 4 cases to one case that had both cystic and atretic follicles.

Ten of the 20 testes studied conformed to the criteria for a normal testis
with neither Leydig-cell hyperplasia nor associated capillary proliferation.
Four of the 20 testes showed an equivocal Leydig-cell hyperplasia (Group 1)
in certain areas but were normal in other areas. The 6 remaining cases showed
a definite Leydig-cell hyperplasia and capillary proliferation (3 in Group II
and 3 in Group III).

Therefore, the 32 specimens from the babies of nontoxemic mothers con-
tained 17 normal gonads (53 per cent). The remaining 15 gonads (5 ovaries
and 10 testes) displayed various deviations from normal. Some of these aber-
rations were minimal, others were marked in their transition. The charts of
the 32 nontoxemic mothers were carefully studied to exclude pre-eclampsia and
eclampsia, especially the cases with the 15 gonads that displayed deviations
from normal. These 15 deviant gonads will be discussed later.

TABLE I.   TOXEMIC SERIES (4 CASES), OVARIES

NAME	AGE	RACE	GRAV-IDA	PARA	WEEK OF GESTA-TION	DIAGNOSIS OF COMPLICATION	GROUP (MATURATION)
Case 1, G. H.	26	White	iii	i	34	Twins; severe pre-eclampsia (? eclampsia); neo-natal death	II. Two follicles seen showing ad-vanced maturation
Case 2, G. F.	36	Negro	vii	vi	40	Moderate pre-eclampsia, still-born female	II. Two follicles seen showing ad-vanced maturation
Case 3, G. F.	23	Negro	ii	i	40	Mild pre-eclampsia, stillborn female	IV. Four cystic-atretic follicles seen, one follicle showing theca-luteinization is present
Case 4, G. F.	28	White	iv	iii	38	Known mild dia-betes for 3 years, obesity, mild pre-eclampsia and hypertension. De-livered 13 pound stillborn female	IV. One follicle seen showing theca-luteinization. Maturation was quite active and all stages seen

The toxemic series was composed of babies from mothers who had either
pre-eclampsia or eclampsia at the time of birth. Babies from mothers with
other incidental and accidental toxemias, if present, were placed in the non-
toxemic group. However, one exception was made. Stroink and Muhlbock[*]
reported high levels of gonadotrophins in the placentas of babies with erythro-
blastosis fetalis. Accordingly, it was felt that the 2 cases of erythroblastosis
fetalis could be included in the toxemic series as also representing the impact
of high maternal gonadotrophins on the fetal gonads.

The toxemic series was composed of 10 babies, 4 of whom were females
and 6 males. All ovaries in this group showed various degrees of follicular
maturation and these in turn were divided into 4 groups following the criteria
proposed by Govan.[10]

Group I, Early Maturation.—This consists of ova surrounded by narrow perivitelline spaces with well-developed antra. These follicles were all greater than 10 microns in diameter and displayed a theca interna that was beginning to become prominent.

Group II, Advanced Maturation.—This consists of follicles which are larger and have prominent perivitelline spaces and well-developed antra with the ova and cumuli pushed to one side. The theca interna shows invasion by small capillaries and is composed of 4 to 6 cell layers of small ellipsoidal cells with prominent nuclei.

Group III, Cystic Atresia.—Ova are seen in large cystic follicles that have a thin granulosa layer and a prominent well-developed theca interna 6 to 10 layers thick with many engorged capillaries transversing it. The atretic follicles are similar but do not show ova. This group, ranging from 3 to 6 mm. in diameter, is readily visible to the naked eye.
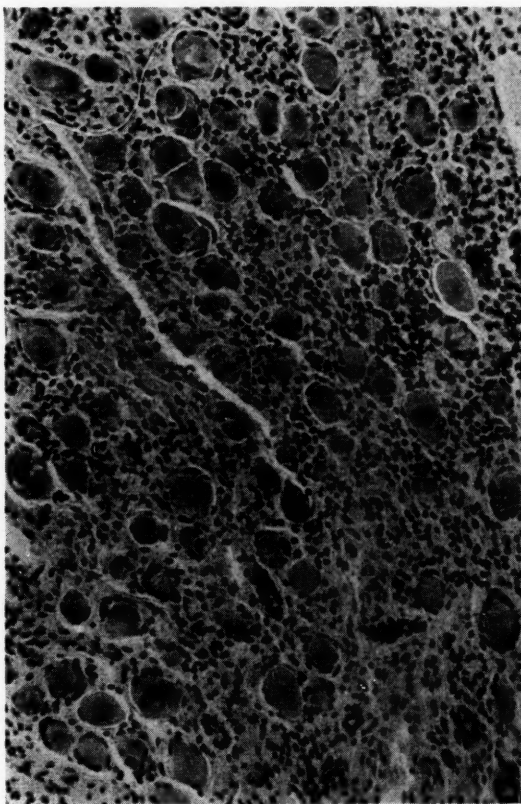
Fig. 3. Fig. 4.

Fig. 3.—Normal fetal ovary.
Fig. 4.—Fetal ovary showing a cystic atretic follicle (Group III).
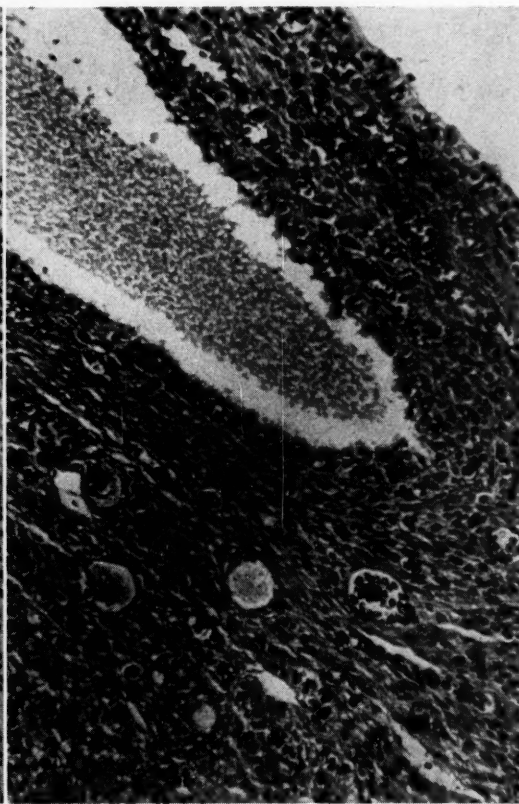
Group IV, Theca-luteinization.—The theca interna is proliferated and the typical lutein cells are seen. Capillary proliferation and hemorrhage are a prominent feature of this layer.

These 4 groups have merely arbitrary end points in a dynamic process of maturation. It is obvious that the ovary is classified in the group of most advanced maturation, but other stages leading up to this group are also present.

TABLE II. TOXEMIC SERIES (6 CASES), TESTES

NAME	AGE	RACE	GRAV-IDA	PARA	WEEK OF GESTA-TION	DIAGNOSIS OF COMPLICATION	GROUP (HYPERPLASIA)
Case 1, B. F.	24	White	iii	ii	36	Mother Rh positive, AB incompatibility. Delivered 3,700 gram stillborn infant with erythroblastosis fetalis	I. Equivocal hyperplasia
Case 2, B. P.	21	White	i	0	32-34	Moderately severe pre-eclampsia with abruptio placentae. Delivered 2,030 gram stillborn male	I. Equivocal hyperplasia with marked hemorrhage into the parenchyma of the testis
Case 3, B. W.	21	White	i	0	40	Moderate pre-eclampsia with cephalopelvic disproportion. Cesarean section done and a macerated 3,150 gram stillborn male was extracted	II. Hyperplasia of Leydig cells with associated capillary proliferation
Case 4, B. W.	18	White	i	0	40	Mild pre-eclampsia. Delivered a macerated stillborn male after induction	II. Increased number of Leydig cells with slight capillary proliferation and engorgement
Case 5, B. H.	30	White	iii	ii	40	Diagnosis made of intrauterine death, induction resulted in the delivery of a 4,060 gram macerated stillborn male with erythroblastosis fetalis	II. Increased number of Leydig cells with minimal capillary proliferation
Case 6, B. B.	20	Negro	iii	i	27	Moderately severe pre-eclampsia became worse on conservative therapy. Hysterotomy resulted in delivery of 640 gram stillborn male	II. Increased number of Leydig cells with no striking capillary proliferation

The 4 ovaries in the toxemic series all showed consistent findings of maturation and were as follows: Group I, no cases; Group II, 2 cases; Group III, no cases; Group IV, 2 cases.

In the cases studied the conclusion reached is that maternal toxemia causes increased fetal ovarian activity as evidenced by various degrees of follicular maturation. This conclusion substantiates that found by Govan.[10] However, the findings of this report do not agree with Govan's that the clinical severity of the toxemia is directly reflected by fetal ovarian activity.

The 6 testes in the toxemic babies all showed various aberrations from normal and were also classified into arbitrary groups. The amount of interstitial Leydig-cell hyperplasia with associated capillary proliferation and engorgement determined the following 3 groups:

Group I, Equivocal Hyperplasia.—Leydig-cell hyperplasia is seen in some areas of the testis but in other areas the interstitial tissue appears normal. No capillary proliferation or engorgement is found.

Group II, Hyperplasia.—The Leydig cells are so numerous that the other elements of the interstitial tissue are somewhat decreased in amount. Definite capillary proliferation and engorgement are seen.

Group III, Marked Hyperplasia.—The Leydig cells in this group are so numerous that they constitute the major component of the interstitial tissue. Marked capillary proliferation and engorgement are present.

The 6 testes all showed some degree of Leydig-cell hyperplasia and were classified as follows: Group I, Equivocal Hyperplasia, 2 cases; Group II, Hyperplasia, 4 cases; Group III, Marked Hyperplasia, no cases.

It can be concluded from the cases studied that maternal toxemia causes varying degrees of fetal Leydig-cell hyperplasia. The 10 gonads of babies from toxemic mothers all showed various aberrations from normal. In the ovaries various stages of follicular maturation were found and in the testes various degrees of Leydig-cell hyperplasia and capillary proliferation were seen. No selection was made as to length of gestation. Some of the cases were from premature babies that also showed the same consistent findings.

Comment

The changes that have occurred in the gonads of babies from toxemic mothers is assumed to be due to influences of maternal hormones, probably gonadotrophins. Smith and Smith[1-6] have correlated the hormonal changes in pregnancy, both normal and toxemic, and have consistently reported observations of high concentrations of serum gonadotrophins in the toxemias of pregnancy. Stroink and Muhlbock[7] and Govan[8] both confirmed these results. There appears to be some disagreement as to the origin of the gonadotrophin, whether it is placental or hypophyseal in origin. Smith and Smith,[3, 4] Sulman,[11] and Bruner[9] all contend that the placenta elaborates the gonadotrophic hormone, while Govan and Mukherjee[8, 10] feel that the anterior pituitary plays the major role in the production of gonadotrophins.

The gonadotrophins contain principally follicle stimulating hormone (FSH) and luteinizing hormone (LH). FSH originates the stimulation of the primordial follicles to begin maturation and LH acts upon them after a certain degree of follicular ripening has taken place. Since all forms of maturation were observed, it is apparent that both hormones must be present in amounts sufficient to cause this transition. Evans, Simpson, and Austin[12] found that the major constituent of the pituitary gonadotrophins is FSH, and Witschi[13] states that chorionic gonadotrophin also contains chiefly FSH and is low in LH. The changes found in the gonads result both from FSH and from LH as the hormones involved, depending upon which sex is observed. FSH appears to be the principal hormone involved in ovarian maturation since all ovaries showed signs of early maturation, but only 2 showed theca-luteinization. LH appears, however, to be involved in testicular changes, since Leydig-cell hyperplasia was the constant feature observed. Sulman,[11] Twombly,[14] and Heller[15] are all in agreement that LH is a stimulator of the interstitial cells of Leydig. It can be concluded that in maternal toxemia there is an adequate amount of both FSH and LH to stimulate the fetal gonad. The origin of sufficient LH to cause gonadal stimulation in maternal toxemia is either from the pituitary or the placenta or both.

TABLE III. FINDINGS IN THE CASES SHOWING DEVIATIONS FROM NORMAL IN THE
CONTROL SERIES

	MALES (20 CASES)	FEMALES (12 CASES)	TOTALS 32
A. Fetus.—			
1. Congenital defects	3 (15%)	1 (8%)	4 (13%)
a. Central nervous system	1	1	
b. Talipes equinovalgus	2	0	
c. Kidney and urinary bladder	1	0	
B. Mother.—			
1. Vaginal bleeding	5 (25%)	1 (8%)	6 (19%)
a. Undiagnosed	3	1	
b. Abruptio placentae	1	0	
c. Induced (criminal)	1	0	
2. Sepsis	1	1	2 (6%)
a. Acute endometritis	1	0	
b. Pyelitis	0	1	
C. No Pathological Findings			
In mother or fetus	1	2	3 (9%)
Totals	10 (50%)	5 (41%)	15 (47%)

Table III lists the various cases of abnormal gonads in the control group (nontoxemic series). Fifty per cent of the 20 testes examined showed aberrations from normal. One-fourth of these cases were from mothers who displayed some type of vaginal bleeding, 3 cases (15 per cent) were found in babies who had some type of congenital defect, while one mother was in acute sepsis. Five of the 12 ovaries examined (41 per cent) showed various aberrations from normal. In one case each there was sepsis, vaginal bleeding, and a congenital defect. Thirty-two gonads comprised the control series. Seventeen of these cases were normal. Six gonads (19 per cent) were in babies whose mothers displayed some type of vaginal bleeding, 4 of the babies (13 per cent) had some type of congenital defect, and 2 of the gonads (6 per cent) were from babies whose mothers had some type of acute sepsis. In 3 cases (9 per cent) there were no abnormalities in either the mother or the fetus. An interesting but unexplained observation is that in 2 cases (one male and one female) with central nervous system defects, hydrocephalus, and meningoencephalocele, there were deviations from normal. One of Govan's[10] control group showing ovarian maturation also had hydrocephalus.

This series of cases is quite evidently too small for statistical validity, but the consistent findings in the toxemic group merit reporting. It is possible that no single institution will have a large enough series to be statistically significant, and possibly such a series can be achieved only by combining several small reports. The present paper may stimulate further interest in this direction.

Summary and Conclusions

The assumption that the elevated levels of gonadotrophins found in certain abnormal pregnancies would have an effect on the fetal gonads prompted this report of the microscopic findings in the fetal gonads of 42 infants, stillborn or dying in the neonatal period. This represents the first consideration

of the status of the fetal testicle under these circumstances, and the first consideration of the topic in the American literature. Eight of the gonads were from babies of toxemic mothers, 2 from babies with erythroblastosis fetalis; the control group was represented by 32 babies from nontoxemic mothers. While such a series does not permit detailed statistical analysis, the following observations were found with a consistency which merits comment:

1. In the nontoxemic group 17 of the 32 gonads showed no gonadotrophic stimulation at all; in the remaining 15 cases the degree of stimulation was minimal or moderate at most.

2. All of the gonads in the toxemic series displayed some degree of stimulation. While this stimulation was frequently of a marked degree, the severity of the toxemia could not be correlated with the amount of gonadal change.

3. It is assumed that the changes consistently found in the fetal gonads result from the increased levels of gonadotrophins in the abnormal pregnancies studied.

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THE CONDUCT OF LABOR AND RESULTS WITH CONTINUOUS CAUDAL ANESTHESIA

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OF THE many hazards in obstetrics at the time of delivery, anesthetic difficulties are probably second only to hemorrhage. Those qualities which constitute ideal anesthesia cannot be found in any one agent. The least potentially dangerous agents usually give the least satisfactory analgesia and anesthesia for both the obstetrician and parturient.

The multiplicity of drugs and techniques utilized in obstetrical analgesia and anesthesia has provoked discussion on the efficacy of any one procedure. The emphasis has been to find an ''ideal'' which would preclude both maternal and fetal morbidity or mortality.

The problem of pain relief is not a difficult one, but to alleviate pain without altering maternal or fetal physiology considerably influences the choice of drugs and methods of administration.[1]

The disadvantages of the various agents used are known to all and need be considered only briefly. In inhalation anesthesia, the hazards are emesis during the induction into and emergence from anesthesia, and decreased oxygenation, resulting in both maternal and fetal hypoxia. The potentialities of excessive bronchial secretions, tracheal obstruction, explosions, and cardiac arrest are ever present. Accidents, if they occur, happen at the time when the only trained person in the delivery room may be busy at the perineum. In many localities, the obstetrician must depend upon inadequately trained personnel to give anesthesia under the most trying circumstances.

The disadvantages in caudal anesthesia are, again, known to all[2]: mechanical failure, hypotension with fetal hypoxia, inadvertent intrathecal injection, drug toxicity, loss of perineal reflex, and the occaional retardation of labor. These, however, generally occur during the first stage of labor, at a time when all may be free to cope with each situation when and if it may arise. At the time of delivery, the obstetrician may feel relatively secure that he can attend to the mother and infant.

With this in mind, the purpose of this paper is to compare the effects of caudal anesthesia with those of conservative analgesia, such as small doses of Demerol and scopolamine, followed by inhalation anesthesia, on the various aspects of labor, delivery, and the puerperium. The study was undertaken to determine the feasibility of one man acting as an obstetrical team to attain proficiency in both anesthesia and obstetrics.

The technique used to effect caudal analgesia and anesthesia is similar to that advocated by Lull and Hingson.[2] The patient is placed in the left lateral decubitus position. The low back, sacrum, and gluteal groove are prepared as a sterile field. The sacral hiatus is located and the overlying skin and posterior sacrococcygeus ligament are anesthetized through a small (No. 24) needle. A Tuohy needle is then inserted at a 45 degree angle through the sacrococcygeus ligament overlying the sacral hiatus. The hub of the needle is then depressed and the needle advanced approximately 2 inches. The stylet is then withdrawn and aspiration is made to ensure against inadvertent intrathecal puncture. A calculated test dose, not to exceed the equivalent of 100 mg. of procaine, is then given with the tip of the needle pointed dorsally and the hand directly applied to the back over the needle point. Subcutaneous injections of fluid may readily be palpated by this method. A rapid injection of the fluid at this time may also produce pain along the lateral aspect of the thigh down to the knee. This so-called "sciatic sign" may be used as an indicative sign of extradural injection. A period of one to three minutes is allowed to elapse, again to ensure against inadvertent intrathecal injection. A vinyl plastic catheter is then inserted through the needle and beyond its tip an additional 2 inches. The needle is then carefully withdrawn over the catheter. The remainder of the initial dose (20 to 25 c.c.) is then given and the patient observed at frequent designated intervals for changes in blood pressure, sensorium, and pain relief, as will be described later. In regard to the amount of drug administered initially, it can be said that the only consistent thing regarding dosage is the inconsistency of the dose and effect ratio.

In the patients studied, there was no selection as to weight, bony structure of the sacrum, or parity as to the type of anesthesia. Of the group studied, none, purposely, presented obstetrical complications other than questionable outlet disproportion. None presented any of the accepted contraindications to conduction anesthesia as outlined by Hingson,[3] such as known central nervous system disease, local infection, marked anemia, or excessive bleeding which might result in shock. The group which had inhalation anesthesia received conservative amounts of Demerol-scopolamine analgesia and the anesthesia was administered by the anesthesiologist. Those who received caudal analgesia-anesthesia usually were given prophylactically 0.1 to 0.2 Gm. Seconal and occasionally 50 mg. of Demerol if they were exceptionally distressed or excited before the administration of caudal anesthesia. I administered and maintained the continuous caudal anesthesia and delivered all the patients in both groups.

The drugs used in this series of cases were Metycaine, 1.5 per cent, Pontocaine, 0.15 per cent, Xylocaine, 0.75 per cent to 2 per cent, and procaine, 2 per cent. The anesthetic gases were nitrous oxide, cyclopropane, and oxygen. The choice of the gases was left chiefly to the discretion of the anesthetist who administered the appropriate gas for the required procedure.

The first cases were done with Metycaine, 1.5 per cent. This proved to be a satisfactory anesthetizing agent but lacked one important quality. Its effects were evanescent and additional doses of Metycaine (10 to 20 c.c.) at intervals from 30 to 45 minutes were required to maintain relief from pain.

This was then abandoned for Pontocaine, 0.15 per cent. Its virtue lay in the fact that the anesthesia was prolonged. However, it was unsatisfactory in that it was slow in onset of action.

A preparation was then devised to have both rapidity and prolongation in action. This was a mixture of procaine, 2 per cent, Pontocaine, 0.15 per cent, and Adrenalin 1/200,000 dilution. This solution was used for approximately 75 per cent of all cases. The onset of anesthesia was usually within ten minutes, and satisfactory pain relief was maintained for 90 to over 120 minutes. Its virtue also lay in the fact that, since infrequent injections were necessary, the total volume of drug was therefore reduced.

The last drug used was Xylocaine (Astra) in various concentrations from 0.75 per cent to 2 per cent. The latter concentration was rapidly discarded as it was frequently accompanied by marked central nervous system stimulation which, however, was readily controlled with intravenous short-acting barbiturates such as pentobarbital or Pentothal. Satisfactory anesthesia was obtained without untoward reactions with the more dilute concentrations ranging from 0.75 per cent to 1 per cent, to which epinephrine 1/200,000 had been added. This drug had rapidity in action and prolongation with the addition of epinephrine.

All the patients who received caudal anesthesia were given 0.1 to 0.2 Gm. Seconal by mouth when the enemas were concluded. The caudal injections were routinely started when a definite pattern of labor was established, usually at 5 to 6 cm. cervical dilatation in either primigravidas or multiparas. Subsequent or additional injections were made aseptically through the indwelling caudal catheter to ensure anesthesia. Care was exerted to maintain the level of analgesia below T_9.[4]

Once the maximum level of anesthesia was reached, the patients' vital signs were watched by a nurse in attendance. Blood pressure and pulse rates were taken and recorded at five-minute intervals for thirty minutes after the initial dose and then at fifteen-minute intervals. In addition, the patients were personally observed for at least fifteen minutes after the initial dose and after each subsequent injection.

Because some patients were seen by other persons upon admission to the labor room suite, a small number of these received previous injections of Demerol and scopolamine, in addition to barbiturates, much to the author's distress, as these particular women were usually unable to cooperate fully at the time of fetal expulsion. If membranes were intact, amniotomy was done artificially with the usual aseptic precautions when the vertex was engaged and the cervix dilated at least 6 cm. Artificial rupture of the membranes was done as early as possible because it became quite apparent that labor would become retarded during the first stage in the presence of intact membranes. It was also noted that spontaneous rupture of membranes occurred rarely in the presence of caudal anesthesia. One may venture that this may be due to the relaxation of the cervix and lack of counter pressure or shearing action which may be necessary to tear the amniotic membranes.

As soon as the cervix was completely dilated, the patient was encouraged to bear down with the diaphragm and abdominal muscles with each and every contraction. Spontaneous deliveries were assisted with slight Kristeller pressure whenever necessary. Elective low forceps[5] were used instead of heavy fundal pressure. Manual rotations from the occiput posterior or transverse positions to the occiput anterior position were employed when the vertex was on the perineum and when internal rotation had not occurred spontaneously.

Results

In all cases, an attempt was made to ascertain the onset of the second stage of labor and record the duration of the second stage. To be sure, there is room for error, but one may surmise that the errors in each group are comparable and are therefore probably compensated.

The entire group consists of 259 patients, 148 of whom were delivered under caudal anesthesia and 111 under inhalation anesthesia. In the caudal group there were 60 primiparas and 68 multiparas. In addition, there were 4 sets of twins, 1 breech presentation, 3 medium forceps operations, 1 face presentation, and 11 premature infants. In the inhalation group there were 34 primiparas and 66 multiparas. Included also there were 1 breech presentation, 1 medium forceps operation, and 9 premature infants.

Spontaneous deliveries occurred in 16.6 per cent of the primiparas with caudal anesthesia as compared to 41.2 per cent in the inhalation group. Of the multiparas, spontaneous deliveries occurred in 69.1 per cent with caudal anesthesia as compared with 84.8 per cent in the inhalation group. The increase in forceps deliveries is apparent, but the relative ease with which outlet forceps deliveries may be accomplished under caudal anesthesia, in the author's mind, compensates for the increased necessity of intervention.

TABLE I

	NORMAL SPONTANEOUS DELIVERY	ELECTIVE LOW FORCEPS	TOTAL
Primiparas.—			
Caudal	10 (16.6%)	50 (83.3%)	60
Inhalation	14 (41.2%)	20 (58.8%)	34
Multiparas.—			
Caudal	47 (69.1%)	21 (30.9%)	68
Inhalation	56 (84.8%)	10 (15.2%)	66
	CAUDAL	INHALATION	
Miscellaneous.—			
Twins	4	0	
Breech	1	1	
Medium forceps	3	1	
Face	1	0	
Prematures	11	9	
Total	20	11	31
		Grand Total	259

There were 20 premature infants (Table I) delivered, 11 of these being in the caudal group. Of the 9 delivered under inhalation anesthesia, there were 2 neonatal deaths. These neonatal deaths occurred in 1,240 gram and

2,240 gram infants. Autopsy findings revealed only prematurity in the former and a tentorial tear as well as prematurity in the latter. It must be added that none of the 20 premature infants was electively delivered without some form of conduction anesthesia, but due to impending delivery 9 infants were delivered under light general anesthesia.

TABLE II. WEIGHTS AND DURATION OF SECOND STAGE

	WEIGHT IN GRAMS			DURATION OF SECOND STAGE IN MINUTES		
	AVERAGE	MEDIAN	MODE*	AVERAGE	MEDIAN	MODE†
Primiparas.—						
Caudal:						
ELF‡ (50)	3292	3300	3600	90	74	70
NSD§ (10)	3286	3420	3100	66	37	30
Inhalation:						
ELF (20)	3228	3170	3300	59	35	30
NSD (14)	3099	2970	2800	50	41	30
Multiparas.—						
Caudal:						
ELF (21)	3410	3300	3300	51	45	30
NSD (47)	3341	3340	3300	49	37	30
Inhalation:						
ELF (10)	3245	3200	3200	47	47	70
NSD (56)	3338	3340	3000	31	29	30

*100 gram gradient.
†20 minute gradient.
‡Elective low forceps.
§Normal spontaneous delivery.

In Table II, the primiparas are divided into "Inhalation" and "Caudal" groups for comparison. Unfortunately, the numbers are small. One notes a definite trend, however, in that, although there was less spontaneity of delivery in the caudal group, those who delivered spontaneously did so at approximately the same time in both groups even though the weights of the infants in the caudal group were, in general, greater. A similar situation is also found to be present in review of the spontaneous deliveries in multiparas.

Another interesting point may be observed in comparing the second stage of labor of the multipara delivered with forceps in the inhalation group with the comparable caudal group. One sees a fairly marked discrepancy in comparing the mode. Of this small group delivered with forceps in the inhalation group, the greatest number delivered within the time period of 60 to 80 minutes after full dilatation, whereas the largest number of forceps deliveries of multiparas under caudal were accomplished during the time interval between 20 and 40 minutes. This might be explained again by the relative ease in which elective low forceps may be utilized with caudal anesthesia.

The average duration of analgesia in the caudal group is recorded in Table III. From the table we find that the average duration of analgesia ranges between 2½ and 2¾ hours for the primipara and between 2 and 2½ hours for the multipara. As caudal analgesia was started at 5 to 6 cm. cervical dilatation, especially in the primipara, we may assume that this time period would apply for the average duration of labor from 5 to 6 cm. cervical dilatation to delivery. By interpolation of the average duration of labor set forth

by most obstetrical authorities,[6] the duration of labor, particularly in primiparas, is definitely reduced with caudal anesthesia.

No attempt was made to record either blood loss or condition of the infant at the time of birth except in specific instances as was noted previously in regard to prematures. It was the impression of the author that blood loss was somewhat reduced in caudal anesthesia as has been noted by Hingson[3] and Lull.[7] There was no doubt that the condition of the infant at birth under caudal anesthesia was better in so far as tone, color, respirations, fetal heart rate, reflex irritability, and cry at delivery were concerned.[7] None of the babies in either group, however, required any rigorous measures of resuscitation. As a matter of fact, the babies who were delivered under caudal anesthesia responded so quickly that it was often necessary to aspirate the mucus from the nasopharynx before the infant was completely delivered.

TABLE III. DURATION OF ANALGESIA IN CAUDAL GROUP

	AVERAGE DURATION ANALGESIA (MINUTES)	AVERAGE DURATION SECOND STAGE (MINUTES)	AVERAGE DURATION ANALGESIA, FIRST STAGE (MINUTES)
Primiparas.—			
ELF*	151	90	61
NSD†	161	66	95
Multiparas.—			
ELF	148	51	97
NSD	118	49	69

*Elective low forceps.
†Normal spontaneous delivery.

Complicating Factors

Inhalation.—

The prime hazard of inhalation anesthesia in obstetrical patients, namely emesis, occurred but once. The occasion was in a 24-year-old primipara who regurgitated during induction. The airway was successfully cleared by the anesthesiologist, though with a moderate degree of trauma to the nasopharynx. The delivery was then conducted under local (pudendal) infiltration of procaine without further incident. The patient received prophylactic antibiotics and developed no subsequent pulmonary disease.

Manual rotations were necessary in 3 cases which were successfully concluded and resulted in 3 spontaneous births. One medium forceps operation was necessary in a case of an arrested posterior in an anthropoid pelvis.

There was one example of secondary uterine inertia occurring in a multiparous patient. This was successfully treated with intravenous Pitocin (10 minims/500 c.c. 5 per cent dextrose in water) and delivery was by low forceps. In addition, there was one retained placenta requiring manual removal and one late postpartum hemorrhage requiring curettage.

TABLE IV. NECESSITY OF REPEATED POSTPARTUM CATHETERIZATIONS

	FOLLOWING FORCEPS	PRIMIPARAS	MULTIPARAS	TOTAL	% TOTAL
Caudal (148)	12	12	8	20	13.5
Inhalation (111)	5	8	12	20	18.1

Two to six repeated postpartum catheterizations were necessary in 20, or 18.1 per cent, of the parturients before normal bladder function returned. Of these, 8 occurred in primiparas and 5 followed forceps deliveries.

Caudal.—

Satisfactory analgesia and anesthesia were obtained for each patient. There was only one failure in 148 cases to effect caudal anesthesia. This particular patient was given continuous epidural anesthesia through the conventional lumbar route and is included in this group.

In addition to the 3 medium forceps operations, there were 10 failures of spontaneous internal rotation. One may presume that the lack of spontaneous rotation is a result of relaxation of the musculofascial sling and the consequent lack of pelvic resistance necessary, according to most authorities,[6] to accomplish internal rotation. Manual rotation was used in all these cases, resulting in 7 low forceps and 3 spontaneous deliveries. A spontaneous delivery of an occiput posterior also occurred.

Seconday uterine inertia was seen in 4 cases, all during the first stage of labor. These were successfully treated with intravenous Pitocin by the previously described technique.

One case of premature (intrapartum) separation of the placenta occurred with the occiput on the perineal floor. This was successfully treated by a low forceps delivery. Due to the extreme uterine irritability that may occur under conduction anesthesia,[2] one case of retained placenta occurred requiring manual removal. There was one late postpartum hemorrhage requiring a curettage on the eighth postpartum day.

Postpartum catheterizations from 2 to 8 times were necessary in 20, or 13.5 per cent, of the 148 patients. As shown in Table IV, this is slightly reduced as compared to the other group. Of these, 13 occurred in primiparas, and 14 occurred after forceps deliveries. The apparent reduction of catheterizations following caudal anesthesia might be explained by the lack of hard-driving labors against rigid soft parts brought about by pelvic relaxation and subsequent increase in elective low forceps deliveries. It should be noted, however, that care of the bladder was emphasized in the caudal group by insisting that all patients who had residual pelvic analgesia at the conclusion of the third stage were catheterized before leaving the labor room suite. A certain number of distended bladders were avoided because the possibility of overdistention due only to disturbed sensory perception was removed.

In this group there were no "spinal headaches." One patient complained of excessive sacral tenderness which responded to local therapy consisting of an ice pack.

Hypotension was present in 12 cases, or 8 per cent, which did not respond to the usual changes in posture such as elevating the legs or turning the patient to her side to relieve the weight of the gravid uterus on the larger pelvic veins. One encountered somewhat exaggerated examples of postural shock, which have been well described by McRoberts.[8] Since caudal anesthesia is slow in onset as compared to the abrupt change which follows spinal anesthesia,

physiological compensation for the loss of vascular tone may occur at a rate commensurate with the degree of peripheral vasodilatation. To those whose hypotension did not respond to the above measures, ephedrine and Methedrine were employed in small intravenous doses, 25 mg. and 10 mg., respectively, and repeated if necessary.

Summary

The foregoing has been an attempt to demonstrate the feasibility of one man acting as an obstetrical team. A sound basic training in the progress of labor in one who is thoroughly interested in obstetrical anesthesia can preclude many of the disadvantages of continuous caudal anesthesia. Knowledge and experience in each may enhance one's ability to deliver "ideally" healthy, vigorous infants even within the uncomfortable environment of understaffed hospitals.[9, 10]

In summary then:

1. Elective low forceps deliveries are increased with caudal anesthesia but should be regarded as innocuous because of the ease of forceps deliveries under such ideal conditions.

2. Spontaneous deliveries with caudal anesthesia may occur within the same time period after full cervical dilatation as with the usual analgesia followed by inhalation anesthesia.

3. The average duration of labor, particularly in primiparas with ruptured membranes, is seemingly reduced under caudal anesthesia.

4. Postpartum bladder care is decreased with caudal anesthesia.

5. Infants delivered under caudal anesthesia appear more vigorous at birth than those delivered under inhalation anesthesia.

6. Proficiency to the point of better than 95 per cent may be attained in establishing effective caudal anesthesia in unselected patients.

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A PELVIC STUDY. I. THE SACRUM, ITS SIGNIFICANCE IN OBSTETRICS*†

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E ARLY thinking held that the axis of the parturient canal was parallel to the curve of the sacrum, and this was designated the curve of Carus. It is now evident that this axis is a straight line until the pelvic floor is reached where a curve begins. Although Greenhill[1] indicates that much in normal and pathologic labor depends upon the curve of the sacrum, and that it is a factor in the mechanism of labor influencing the movement of the child along the birth canal, little of a specific nature has been written there or elsewhere. As revealed by a brief survey of the obstetrical literature and texts of recent years, the report of Mayer and Morin[2] is the only one to consider the obstetric significance of the sacrum in particular.

Accurate evaluation of the sacrum in obstetrics requires roentgen study. Clinical examination reveals little of the sacrum except its tip, and possibly a point in the proximity of the sacrovertebral angle that is assumed to be the promontory. With the exception of the small, contracted pelvis, it is clinically impossible to determine accurately the nature of the curve of the sacrum. Reliance on clinical examination and lack of experience with the valuable aids of roentgen studies probably account for the lack of specific interest in the sacrum in obstetrics.

A series of 246 primiparous patients have been studied by clinical examination and roentgen pelvimetry, and then observed at delivery subsequently. This study with total evaluation has engendered great interest in the sacrum and its significance in the mechanics of descent and the eventual management of parturition.

To express the sacral variations, six basic types of sacral pelvic curve have been recognized. The designated types are arbitrary, and there is some overlapping in actual classification of a series of pelves. This is no real disadvantage, however, since the purpose is description, not absolute definition. The terms chosen to indicate the six types are likewise arbitrary; again, description, not anthropological or academic definition, was desired.

In Fig. 1, the six basic curves are shown. These drawings were made when the photographs of the original roentgen films were seen to be too vague. The anteroposterior or pelvic curve of the sacrum is seen only in the lateral roentgenograms of the pelvis. The dorsal curve has no significance. The lateral curve is modified by attached soft tissues and is of interest only when modified by rickets with broadening, for example. Soft tissue covers little of the pelvic curve, so that the bony structure as revealed in the roentgenogram is significant in itself.
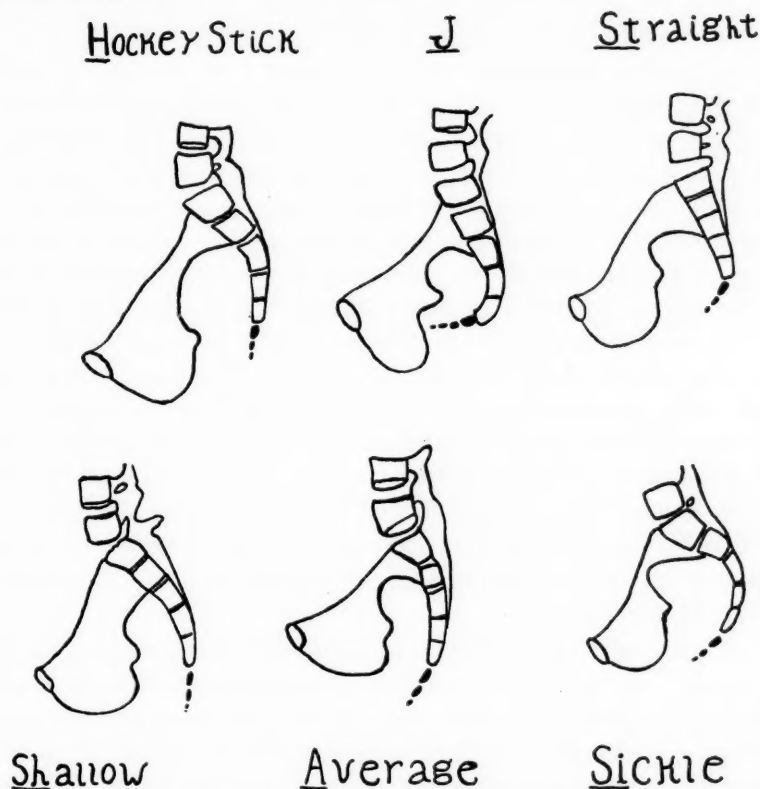
Fig. 1.—The six basic types of sacral curve as shown in drawings to represent the appearance of the lateral roentgenogram of the pelvis.

The etiology of the variations is not clear. Although Morton,[3] and Morton and Hayden[4] were more concerned with the outline of the inlet, they indicated variations in sacral curve at different age levels as part of their study of the development of pelvic conformation in both males and females. Their finding of similar shapes before puberty in both sexes with a difference after puberty suggested a role for sexual hormonal stimulation. However, the effect of heredity and nutrition could not be assessed. The effect of rickets on the sacrum has long been recognized and is described in standard texts.[5]

The incidence of the various sacral-curve types in this series of 246 patients was as follows:

Sickle	27	Average	43
J-shaped	35	Shallow	46
Hockey stick	54	Straight	44

Study of Fig. 1 will indicate the possible overlap of J and H curves, and also of Sh and St curves. The distribution of types is approximately even except for the small incidence of the Sickle-shaped curve.

The data obtained from the pelvic study has been analyzed. In this series, there were 15 platypellic pelves of which 5 had a J sacrum and 4 a Hockey-stick sacrum. Eighteen of the 27 sacral curves of Sickle shape were associated with a brachypellic inlet and 14 with pelves whose midplane had an anteroposterior diameter 1 to 3 cm. greater than the transverse diameter. There were no other apparent relationships between inlet, midplane, and sacral curve.

The J curve has significance in the mechanics of intrapelvic position and rotation of the presenting vertex. In Fig. 2, the outline of the sacral curve as related to the symphysis, ischial spines, inlet, midplane, and anterior and posterior segments is shown. As can be seen, the forward curve of the J sacrum presents a ledge that juts forward to impede descent and rotation of the vertex beyond the midplane. In the absence of a sacral concavity, rotation of the vertex from occiput transverse to the oblique to the anterior position is interfered with and the position persists at the midplane. With the high incidence of J and H curves associated with the platypellic pelvis, we see a reason for the persistence of the occiput transverse position at the midplane. In our experience, over 60 per cent of platypellic pelves had a greater anteroposterior diameter than tranverse diameter at the midplane, so it would otherwise be expected that rotation to oblique or anterior positions would occur—would occur, that is, except that the absence of a sacral concavity and the projecting sacral tip interfere. This failure of rotation is a characteristic of spontaneous labor in that rotation is usually readily accomplished either manually or with forceps, as may be elected by the operator.

Further study of Fig. 2 will reveal the possible similar effects of the Si and H sacral curves. In our study, reasonably accurate observation of the mechanism of descent was possible in 178 cases. At the midplane, 88 had occiput transverse position. Forty-four of these were associated with J, H, or Si curves. Occiput posterior positions occurred equally with all types of sacral curve. Oblique positions occurred as follows: J and H, 22; Sh and St, 15; A, 15; and Si, 0.

The Sickle-shaped curve is quite striking in that the plane of greatest diameter (Levret) has a greater anteroposterior diameter than either the inlet or midplane. The importance of the forward-jutting sacral tip has been indicated. In instances of occiput posterior or occiput transverse arrest, when rotation is indicated, the vertex should be displaced into the plane of greatest diameter where the most room is available for any maneuvers.

The Average curve is so-called not because of any mathematical derivation. This term has been selected as preferred to the less desirable ''normal,'' always a misleading term. It is average only in the sense that it is this particular type of curve which is most commonly shown in illustrations of standard texts.

The Straight and Shallow curves also have obstetric significance. Of the patients studied in this series, 111 were either less than 5 feet, 2 inches tall or more than 5 feet, 6 inches tall. Of these 111 at opposite extremes, 58, or more

than half, had either *St* or *Sh* sacral curves. The small person with an *Sh* or *St* sacrum has a larger pelvis because of less encroachment posteriorly by the sacrum. This, plus the presence of a thin bony structure, explains the finding of a very capable pelvic cavity despite very small, contracted external measurements. The tall patient with an *Sh* or *St* sacrum likewise has less encroachment of the sacrum into the posterior segment. Externally, a more prominent sacral curve might be associated with undue prominence of the buttocks.

The *St* and *Sh* curves have another point of practical significance. Manual measurement of the diagonal conjugate diameter is commonly carried out and given great prognostic significance. In the absence of an *St* or *Sh* curve, this may be taken as an indication of anteroposterior contraction of the inlet. However, with a flat sacral curve, short fingers may reach what they regard as the level of the inlet at 9.5 or 10 cm. When the same pelvis is measured by a set of longer fingers, the diagonal conjugate may be 12.5 or 13 cm. This is particularly true when the flat sacrum has a forward angulation so that it progressively encroaches upon the posterior segment as it goes from inlet to midplane. This is the prime example of the value of roentgen examination of the obstetric patient as opposed to the inadequacy of clinical evaluation of the sacrum.
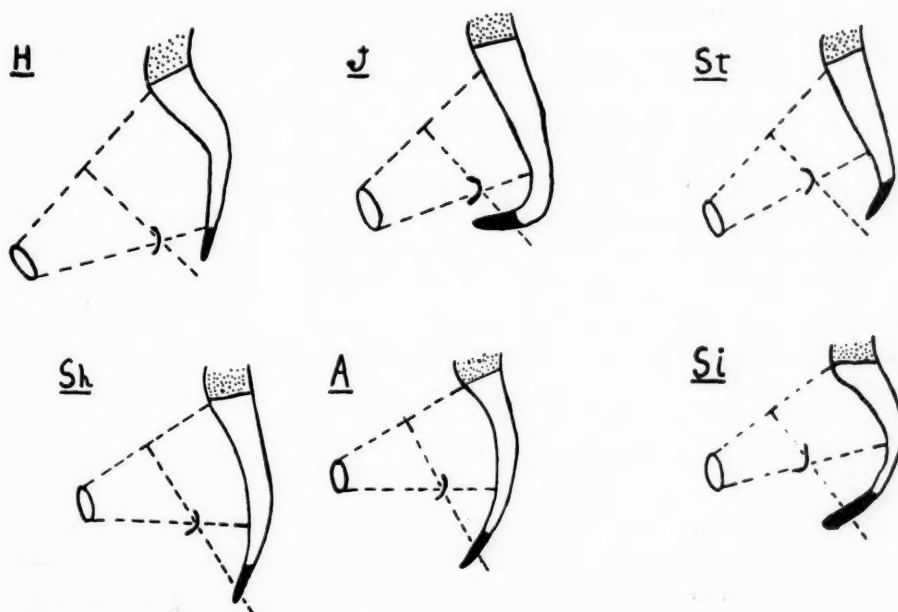
Fig. 2.—The relationship of the six basic types of sacral curve to the symphysis, ischial spines, inlet, midplane, and anterior and posterior segments is shown in these outline drawings.

The influence of the sacrum on the space available in the posterior segment is more clearly shown when Hodge's parallel planes are employed in pelvic analysis. When the third and fourth planes are placed, as might be superimposed on Fig. 2, the encroachment of the *J, H,* and the forward-inclined *Sh* or *St* sacral curves is more clearly indicated. It is apparent that the sacral curve will significantly decrease the available space in the posterior segment, under such circumstances, and the obstetrician must then realize the necessity

of delivery through the anterior segment. If the anterior segment is also decreased in itself, then the possibility of disproportion becomes increasingly greater.

Problems arising in the midplevis, when the greatest diameter of the vertex is through or beyond the inlet, require the greatest skill and judgment. If one believes in the importance of avoiding unnecessary sections as well as vaginal deliveries that are traumatic to both mother and child, all knowledge becomes important. If a trial forceps delivery is to be attempted, knowledge of the sacral curve becomes important.

For example, the problem of persistent occiput posterior arrest, that will require rotation because of an inadequate posterior segment at the outlet, may be managed by either the Scanzoni or the Bill maneuver. The choice will depend upon the capacity of the pelvis in general, and the capacity in particular as influenced by the type of sacral curve present, and the degree of its encroachment upon the posterior segment. Unless the operator has a knowledge of the pelvis and the type of sacral curve present, his choice of procedure will be a matter of chance. With roentgen equipment so generally available, why should the choice between an easy and atraumatic or possibly a very traumatic and shocking delivery be a matter of chance?

Roentgen pelvimetry indicates the relative diameters and capacity at the inlet and midplane, as well as the nature of the sacral curve. Clinical pelvimetry indicates the relationships of the pubic arch, ischial spines, sacrospinous ligaments, side walls, and the position of the sacral tip in the posterior segment of the midplane. When all of this knowledge is combined, the responsible obstetrician has a total evaluation of the particular pelvis. Not only is he often able to predict the most likely mechanism of descent, but he is able to appreciate problems of positional dystocia as they arise. Most important, and extremely practical, he knows where rotations may be most easily and most safely accomplished, and whether the transverse, posterior, oblique, or anterior position is most favorable at each station in the pelvis.

Summary

This report has presented the six basic types of pelvic sacral curve, together with a discussion of their obstetric significance. The importance of knowledge of the sacrum in obstetric management has been emphasized. The value of this knowledge lies in its role as part of a total pelvic evaluation that gives a descriptive profile of the entire pelvis, a description arising from both clinical and roentgen techniques.

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FACE AND BROW PRESENTATIONS

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THIS paper analyzes 139 face and 26 brow presentations which occurred in 76,062 deliveries at the Elizabeth Steel Magee Hospital from Jan. 1, 1930, to May 31, 1952. In this series, face presentation has an incidence of 1 in 547; brow, 1 in 2,941; the combined incidence is 1 in 461. Table I is a comparison of the recently reported series of face and brow presentations.

TABLE I. FACE AND BROW PRESENTATION

AUTHOR AND HOSPITAL	TOTAL DELIVERIES	FACE	INCIDENCE	RATE	CORRECTED FETAL MORTALITY (%)	MATER- NAL DEATHS
Comparison of Recently Reported Series of Face Presentations						
Posner and Buch[1] Harlem Hospital	46,058	87	0.190	1:529	19.6	1
Rudolph, S. J.[2] Philadelphia Lying In	36,163	61	0.173	1:576	7.6	0
Tucker, et al.[3] Chicago Maternity Center	39,687	73	0.184	1:544	9.4	0
Hellman, et al.[4] Johns Hopkins	69,930	141	0.214	1:468	11.4	0
Posner and Cohn[5] Bronx Hospital	36,021	45	0.125	1:800	12.1	1
Reddoch, J. W.[6] Charity Hospital	88,114	160	0.184	1:544	17.3	2
Author's series Magee Hospital	76,062	139	0.183	1:547	9.3	2
Combined	392,035	706	0.180	1:556	13.0	6
Comparison of Recently Reported Series of Brow Presentations						
Posner and Buch[1] Harlem Hospital	46,058	13	0.028	1:3,543	20	2
Hellman et al.[4] Johns Hopkins	69,930	44	0.060	1:1,498	25	3
Author's series Magee Hospital	76,062	26	0.034	1:2,941	8.7	0
Combined	192,050	83	0.043	1:2,314	19.5	5

Hellman and co-workers[4] called attention to the paucity of published reports on brow presentation and presented a series of 44 with an incidence of 1 in 1,498. In the present series there are 26 brow presentations, an incidence of about half that magnitude. However, our incidence is more in agreement with the findings of Posner and Buch,[1] who feel, as I do, that brow is usually a transition stage between full flexion to a vertex and full extension to a face, and confined their cases to those which persisted as brow presentations until

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the patients were placed on the table for delivery. As the problem presented
and the management received are essentially the same, some aspects of face
and brow presentation are analyzed jointly in this report.

Incidence according to age of patient is presented in Table II, which re-
veals a higher percentage of patients over the age of 30 years than is found in
the general obstetric population. This is interpreted as a reflection of the find-
ings in Table III, which illustrates a greater incidence of extended fetal head
in the multiparous patient. In this series 66⅔ per cent were multiparas, as
contrasted with 56 per cent multiparas in all deliveries at this hospital. This
deviation of 10⅔ per cent is statistically significant. The explanation for the
higher incidence of face and brow presentations in multiparas is probably the
one most frequently offered, namely, that a faulty uterine axis due to the dimin-
ished tonicity of the abdominal and pelvic tissues increases with parity.

TABLE II.   INCIDENCE OF FACE AND BROW PRESENTATION ACCORDING TO AGE

	0-19 YEARS	20-29 YEARS	30-34 YEARS	35 YEARS AND MORE	TOTAL
Patients	14	84	38	29	165
Percentage	8	52	23	17	100

TABLE III.   INCIDENCE OF FACE AND BROW PRESENTATION ACCORDING TO PARITY

	MINIMUM PARITY				TOTAL
	1	2	3	4	
Patients	55	110	67	31	165
Percentage	33⅓	66⅔			

Factors other than multiparity which cause extension of the fetal head
are listed in Table IV. Of the numerous possibilities, the most common etio-
logical factor was cephalopelvic disproportion. In 25 instances it was due to a
contracted pelvis and 18 times it was caused by a large baby and a normal
pelvis. On the other hand, a baby too small for a given pelvis is predisposed
to a face or brow presentation. Supporting this thought are the 21 cases of
premature labor which yielded through normal pelves babies under 2,500 grams.

TABLE IV.   INCIDENCE OF POSSIBLE ETIOLOGICAL FACTORS IN THIS SERIES OF FACE AND BROW

POSSIBLE ETIOLOGICAL FACTOR		NUMBER	PERCENTAGE
Contracted pelvis		25	15.1
Large baby		18	10.9
8½ to 9½ pounds	11		
Over 9½ pounds	7		
Prematurity (small baby)		21	12.4
Cord loops about neck		14	8.5
Monstrosity		11	6.6
Multiple pregnancy (twins)		5	3.1
Hydramnios (normal baby)		3	1.8
Prolapsed cord		2	1.2
Fibroid in lower uterine segment		1	.6
Placenta previa		1	.6
Total		101	61.2

Excluding multiparity, a possible etiological factor was found in 101, or 61.2 per cent of the cases. Therefore, it is of importance to the obstetrician, the patient, and the infant that any possible etiological factor be discovered. Cognizance of a cephalopelvic disproportion, a monster, or a premature infant will enable the obstetrician to select judiciously the method of management for the individual case.

Early recognition of a face or brow presentation is rather infrequent. This fact is obtained from reviewing the 6 recently reported series. Only two authors[1, 5] gave a percentage of correct diagnoses before delivery. Table V gives the names of the authors as well as the combined percentages for correct diagnosis before the patient was placed on the table for delivery. There is no reason to assume that in the series in which this aspect was unreported the physicians had any more awareness of the malpresentation. In only 53.2 per cent of all the labors did the obstetrician know that he was dealing with a face or brow presentation. The diagnosis depends upon abdominal palpation, rectal and vaginal examinations, and roentgenograms. There should be no hesitation in performing a vaginal examination on any patient in labor when there is the slightest doubt as to the presentation. At the same time the size of the fetus and the adequacy of the pelvis should be estimated. This is followed by x-ray pelvimetry and fetal evaluation in those cases in which uncertainty persists. This routine would avoid a cesarean section that yields an abnormal baby. Careful examinations will permit earlier recognition and, in turn, better care during a labor which may be terminated by cesarean section. Fluids, antibiotics, sedation, and care of the bladder and the rectum are important measures in these patients.

TABLE V. PERCENTAGE OF CORRECT DIAGNOSES OF FACE OR BROW BEFORE PATIENT WAS PLACED ON TABLE FOR DELIVERY

AUTHOR	HOSPITAL	PERCENTAGE OF CORRECT DIAGNOSES	NUMBER OF PATIENTS
Posner and Buch[1]	Harlem	51	100
Posner and Cohn[5]	Bronx	62	45
Author's series	Magee	52	165
Combined		53.2	310

TABLE VI. FACE AND BROW PRESENTATION—POSITION OF FETUS AT TIME OF DELIVERY

	RIGHT	LEFT	NOT STATED	TOTAL
Face Presentation.—				
Mentum anterior	30	56	5	91
Mentum transverse	10	6	0	16
Mentum posterior	20	10	1	31
Mentum, not stated	0	0	1	1
Total face	60	72	7	139
Brow Presentation.—				
Sinciput anterior	8	7	0	15
Sinciput transverse	0	0	0	0
Sinciput posterior	4	1	1	6
Sinciput, not stated	0	0	5	5
Total brow	12	8	6	26

The incidence of the various positions at the time of delivery is shown in Table VI. Mentum and brow anterior occurred approximately 3 times more often than the corresponding posterior position. When the oblique positions are analyzed, the right oblique diameter of the pelvis (LMA, RMP, LBA, RBP) was occupied nearly twice as often as the left oblique. Sixteen of the 139 face and none of the brow presentations were in the transverse of the pelvis.

Labor was studied excluding those factors which would influence its duration unduly, namely, premature, monstrous, and macerated infants, and cesarean sections. Two recent reports[3, 5] state that labor in face and brow presentations was not significantly prolonged. The conclusions are based on the study of the average lengths of labor (face, brow vs. vertex). In this series, the duration of labor is analyzed by arbitrarily considering any labor in excess of 24 hours in a primipara and 18 hours in a multipara as prolonged. The findings are expressed in Table VII which shows that practically 1 out of every 4 labors was prolonged.

TABLE VII.   LENGTH OF LABOR IN FACE AND BROW PRESENTATION

PARITY	TOTAL	NO. WITH PROLONGED LABOR	PERCENTAGE WITH PROLONGED LABOR
Primiparas	38	7	18.4
Multiparas	87	23	26.4
Combined	125	30	24.0

As is expected in any series of cases with a high percentage of operative deliveries (46.9 per cent in this report), the complications of delivery and the puerperal morbidity were increased. The complications of delivery are recorded in Table VIII.

TABLE VIII.   COMPLICATIONS OF DELIVERY OF FACE AND BROW

Hemorrhage	6
Sulcus lacerations	4
Physiological contraction rings	4
Cervical lacerations	3
Hysterectomy (for hemorrhage from uterine atony)	1
There were no third-degree lacerations or uterine ruptures	

Morbidity is defined as an elevation of temperature to or over 100.4° F. for 2 consecutive days excluding the first 24 hour period. Fifteen of the 165 mothers were morbid; an incidence of 1 in 11, or 9.9 per cent. Two mothers were lost. The direct causes of death were septicemia from a lung abscess caused by aspiration of vomitus in one and pulmonary emboli in the other. These cases are presented briefly for reflection.

Hospital No. 58141. A 30-year-old gravida iv, para iii, was admitted on Sept. 26, 1931. The estimated date of confinement was Sept. 10, 1931. Her past history revealed large babies and short labors. After 21 hours of labor the cervix was fully dilated and the fetus was in the right mentum posterior. The membranes had ruptured and the cord prolapsed. Immediate preparations were made for delivery by internal podalic version and extraction under ether and chloroform anesthesia. The fetal heart sounds became inaudible before delivery. The anesthesia was unsatisfactory and before the extraction was started the patient

aspirated vomitus. A 3,805 gram stillborn infant was delivered. The puerperium was febrile, there was evidence in the chest of severe pneumonia, and the patient died on the eighth postpartum day. Autopsy showed multiple large lung abscesses.

Hospital No. 11480. A 23-year-old primigravida was admitted March 12, 1943, after an uneventful antepartum period. The estimated date of confinement was March 8, 1943. No pelvic measurements were recorded on her prenatal record. After 51 hours of labor, full dilatation of the cervix was achieved but the presenting part was not engaged. Two hours later the membranes were ruptured by a consultant who diagnosed left mentum posterior presentation and performed a difficult internal podalic version and extraction, yielding a 3,290 gram infant that did well subsequently. Bilateral sulcus lacerations were sutured and the uterus was packed with 5 yards of plain gauze. The puerperium was progressively febrile and on the thirty-fourth postpartum day the mother died after several episodes of pulmonary distress. Autopsy showed the cause of death to be thrombophlebitis and multiple pulmonary emboli, originating in the right ovarian vein and extending into the inferior vena cava.

In the first case the mortality can be attributed to the inadequate anesthesia under which the fatal aspiration of vomitus occurred. The second was mismanaged during labor. A realization of the cephalopelvic disproportion, its evaluation earlier in the labor, and termination by cesarean section could not have given more disastrous maternal results.

Perusal of Table IX gives the fetal mortality for the various methods of delivery with an analysis of their results in comparison with parity and duration of labor. The fetal mortality is corrected for premature (under 2,500 grams), monstrous, and macerated infants. All the fetal deaths occurred in the cases of spontaneous birth or delivery by internal podalic version and extraction. No babies or mothers were lost in the groups delivered by forceps or cesarean section. In this institution, there is a trend away from internal podalic version and extraction and toward cesarean section for this malpresentation. No sections had been performed before 1944. Further study of Table IX reveals that fetal mortality rises sharply in prolonged labor and is also much higher in the primipara than in the multipara. The corrected fetal mortality for primiparas is 14.3 per cent, for multiparas it is 6.8 per cent; for labors of normal length in both it is 6 per cent and for prolonged labors in both it is 19.3 per cent. Corrected fetal mortality figures and percentages for the various methods of delivery in primiparas and multiparas with a breakdown for the type of labor are also available in Table IX.

The various positions of the face and brow presentations with their method of delivery are shown in Table X. Spontaneous delivery of mature live infants occurred from all positions; however, the posterior position of the extended fetal head is the most vexatious and is the group in which the maternal deaths and the highest fetal mortality in this series occurred.

Table XI contains the incidence of mentum posterior in this and other reports and suggests that it is consistently about 25 per cent. DeLee[7] sagaciously stated that "mentosacral positions terminating happily for the mother and the child are so exceedingly rare that for practical purposes it is best to consider them as absolutely impossible and as always requiring interference from art." The absolute necessity for interference is contradicted by the 4 mature live infants that were delivered spontaneously from the posterior face position, but

TABLE IX. CORRECTED* FETAL MORTALITY OF FACE AND BROW PRESENTATION VS. METHOD OF DELIVERY, PARITY, AND LENGTH OF LABOR

METHOD OF DELIVERY	PRIMIPARAS			MULTIPARAS			COMBINED		
	LABOR OF NORMAL LENGTH	PROLONGED LABOR	CORRECTED FETAL MORTALITY	LABOR OF NORMAL LENGTH	PROLONGED LABOR	CORRECTED FETAL MORTALITY	TOTAL NUMBER DELIVERED BY METHOD	PERCENTAGE OF TOTAL DELIVERED BY METHOD	FETAL MORTALITY FOR METHOD
Spontaneous									
Live births	2	0		23	6		31	26.2	8.8%
Deaths†	2	0	50%	0	1	3.3%	3		
Version and extraction									
Live births	9	4		19	9		41	38.4	18%
Deaths†	2	2	23.5%	2	3	15.1%	9		
Low forceps									
Live births	13	1		18	3		35	26.9	None
Deaths†	0	0	None	0	0	None	0		
Midforceps									
Live births	2	0		2	1		5	3.8	None
Deaths†	0	0	None	0	0	None	0		
High forceps									
Live births	1	0		0	0		1	0.7	None
Deaths†	0	0	None	0	0	None	0		
Cesarean Section									
Live births	4	0		0	1		5	3.8	None
Deaths†	0	0	None	0	0	None	0		
Total	35	7		64	24		130		
Corrected fetal mortality	11.4%	28.5%		3.1%	16.6%		Normal labor		6%
							Prolonged labor		19.3%
	14.3%			6.8%				9.2%	

*The table is corrected for premature, macerated and monstrous infants.
†Mature stillborn infants and neonatal deaths within 10 days.

TABLE X.   ANALYSIS OF CORRECTED* FETAL MORTALITY RATE VS. POSITION AND
METHOD OF DELIVERY

POSITION	TOTAL	SPONTANE-OUS	FORCEPS			VERSION AND EXTRACTION	CESAR-EAN	CORRECTED FETAL MORTALITY RATE	
			LOW	MID	HIGH				
Anterior	77	28	29	3	1	14	2	Combined	5.2%
Face	64	3 face				1 face death		Face	6.3%
Brow	13	deaths†						Brow	0
Transverse	14	2	3	1	0	7	1	Combined	7.1%
Face	14					1 face death		Face	7.1%
Brow	0							Brow	0
Posterior	36	4	3	1	0	27	1	Combined	19.4%
Face	29					5 face deaths		Face	17.2%
Brow	7					2 brow deaths		Brow	28.5%
Not stated	3	0	0	0	0	2	1	Combined	0
Face	0								
Brow	3								

*The table is corrected for premature, macerated and monstrous infants.
†Mature stillborn infants and neonatal deaths within 10 days.

The corrected fetal mortality rate for face and brow is 12 in 130, or 9.2 per cent;
for face 10 in 107, or 9.3 per cent; for brow 2 in 23, or 8.7 per cent.

TABLE XI.   INCIDENCE AND FETAL MORTALITY RATE OF MENTUM POSTERIOR PRESENTATIONS

AUTHOR	PERCENTAGE OF FACE PRESENTATIONS THAT ARE MENTUM POSTERIOR	CORRECTED FETAL MORTALITY
Posner and Buch[1]	26.7	16.7%
Rudolph, S. J.[2]	32.1	
Reddoch, J. W.[6]	25.0	
Tucker et al.[3]	20.3	23.8%
Hellman et al.[4]	32.7	
Author's series	27.1	17.2%

all writers agree that failure to advance or rotate is a definite indication for
assistance.

Five manual and 4 forceps rotations of mentum posterior to mentum
anterior position were successful.   There were 11 unsuccessful attempts at con-
version recorded.   Forceps failures occurred twice and the delivery was accom-
plished by internal podalic version and extraction, with good results.

Although version and extraction had the highest fetal mortality in this
series, and has been denounced by Reddoch[6] as having no place in the modern
management of face and brow presentations, I feel that it is a timely and
valuable procedure when practiced without violating the conditions under which
this operation can be expected to be successful.   In brief, the conditions, as
stated by Erving,[8, 9] are: absence of cephalopelvic disproportion, fully dilatable
cervix, membranes intact or recently ruptured, a displaceable head, adequate
anesthesia, and an experienced operator.   Our poorest results by version and
extraction were obtained when one or more of these conditions was not present.
Reddoch's[6] fetal mortality for version and extraction was 53.3 per cent; in this
series it is 18 per cent.   Reddoch's[6] corrected fetal mortality for all face presen-
tations was 17.3 per cent.   In this institution, when attempts at conversion and
forceps delivery have failed, version and extraction are the last resort for a
vaginal delivery.   If the conditions under which a successful performance can
be anticipated are not present, then a cesarean section should be done.

Conclusions

1. An analysis of a series of face and brow presentations is submitted.

2. Parity, cephalopelvic disproportion, prematurity, and fetal abnormalities are important etiologically.

3. Early recognition of this malpresentation is infrequent. An appeal is made for more careful examinations, complete evaluation on an individual basis and for management of the labor on the premise that the patient is a likely candidate for cesarean section.

4. Fetal mortality is higher in the primipara, in prolonged labor, and in the posterior variety of face and brow presentations.

5. The methods of delivery are studied. Internal podalic version and extraction is a valuable procedure when certain rigid prerequisites for its performance are fulfilled. Cesarean section should be resorted to earlier and more frequently.

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HYPEREXTENSION OF THE FETAL HEAD IN BREECH PRESENTATION

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THE problem of breech presentation has been thoroughly studied and most phases have been analyzed critically. We know that breech babies ordinarily make up 4 per cent of all births, that there are more breech babies born to primiparous than to multiparous mothers, that fetal mortality is higher in breech than vertex deliveries, that the incidence of section is slightly higher in this type of presentation, and that maternal mortality is also slightly higher. Authority for these statements can be found in the standard obstetric reference books and in the many reports analyzing large series of cases of breech presentation. Experienced obstetricians are alert to the added dangers of breech delivery and most agree that in at least one instance, that of the elderly primigravida (with breech presentation), vaginal delivery takes second place to delivery by section in choice of treatment.

There is, however, a phase of the problem which has not received its proper share of emphasis in the study of breech presentation. That phase is the consideration of fetal attitude. There is no mention in text or reference books of obstetrics of the special handling required in instances where there is malattitude of the head along with breech presentation. Irving Stein[4] (1941) made an inclusive study of all kinds of deflection attitudes in breech babies in utero. After consideration of the problem he stated that most breech babies showed deflection of one or more parts including head, spine, upper and lower extremities. He advised against external version for the reason that this deflection exists, and he recommended careful attention to managing deflexed parts during vaginal delivery. He warned that fundal pressure during delivery, that is, following the head down, might cause deflection of the upper extremities with consequent extension further along during extraction.

Stein did not consider the condition of deflection of any part to be sufficiently serious to warrant delivery by section. Neither did Reis and DeCosta[3] (1950), who reported two cases of breech presentation in which x-rays taken late in pregnancy disclosed rotation and deflection of the head. In both of these cases there was spontaneous resolution of the malattitudes into favorable attitudes. Flection and straightening of the head of one baby were detected by manual palpation at the time of elective section for malattitude, while the assuming of occiput anterior position by the other baby was proved

by repeat x-ray after a week's interval, from which position the baby was
delivered spontaneously. Reis and DeCosta were emphatic in their statement
that deflection with hyperrotation of the head in breech presentation does not
constitute an indication for cesarean section. In managing their first case
these authors fell into the old pitfall of presuming that the fetal attitude and
presentation are static. On the contrary, we know that these features are
capable of being changed at any time up to the closing hours of pregnancy.

Fig. 1.   Fig. 2.

Two single case reports have appeared in the literature, one by J. C.
Taylor[5] (1948), the other by G. F. Melody[2] (1948), on breech with hyperex-
tended head and in both of these instances the babies suffered major damage.
J. C. Taylor performed an elective section at term after two successive x-ray
examinations showed the baby to be stable in this position; roentgenograms
of the baby's spine on the sixth day of life showed anterior dislocation of
C_1, C_2, and C_3 on C_4. This deformity was successfully treated by application
of a splint. The baby in Melody's case was found to have bilateral posterior
dislocations of the tibiae.

An extensive study of breech presentation was conducted by Wilcox[6]
(1949), who found among 1,918 breech deliveries 23 instances where there was
mild to extreme extension of the head; 11 are listed as having hyperextension
of the head. The author emphasizes that these cases were handled in a very
conservative manner (Women's Clinic of the New York Hospital), yet 4 of

the 23 were delivered by section. One baby was lost as a result of transection of the spinal cord after vaginal delivery, and one baby (vaginal delivery) was deadborn. In only one instance did Wilcox find a definite etiological factor for the hyperextended attitude; that baby had a congenital cyst of the neck.

Wilcox's recommendation for the managing of this abnormality is to individualize each case. He quotes, and disagrees with, Otto Brakemann (1936) who believes that a more difficult labor and delivery may be expected with the hyperextended head and that cesarean section is the preferred treatment.

Recently, we have had occasion to manage a case of breech presentation with hyperextended head with good result in both mother and baby. A normal 19-year-old primigravida, seen in regular prenatal visits, was examined abdominally at the thirty-seventh week and found by one of us (Moore) to have atypical breech presentation. The head felt as though it were on the same side as the fetal back. A roentgenogram showed the baby to be presenting by breech, the cervical spine to be hyperextended all the way so that the baby's face was directed upward (Figs. 1 and 2). At the thirty-ninth week, repeat x-rays showed the position to be unchanged. External manipulation was done with the aim of flexing the head. This process failed to accomplish the objective. Cesarean section was performed before the patient went into labor; the baby, delivered without difficulty, weighed 6 pounds, 11 ounces. The head was found to be hyperextended at the time of delivery. In his crib in the nursery the baby assumed the hyperextended attitude which sometimes is assumed by babies who have lain in face presentation in utero. No abnormalities of the neck or spine were noted; the baby developed normally.

Comment

Cause.—There is no single etiological factor common to cases of hyperextension of the head, just as there is no single cause responsible for malattitudes and malpresentations in general, most authorities agreeing that a multiplicity of causes exist. Spasm of fetal muscles (Gibberd[1]), uterine anomalies, uterine tumors—all these factors have been incriminated. Reis and DeCosta believe chance plays the major role, since the one common denominator of most of these bizarre presentations is a lack of definite cause. This lack was noted in our case. Regardless of the inciting cause, in hyperextension it is frequently noted that the baby's muscles are functionally shortened after he has occupied the attitude for any appreciable length of time. This fact undoubtedly explains why many cases of hyperextension cannot be converted into flection, particularly after the abnormality has existed for some time. The period of "fixing" should be considered in judging whether corrective manipulation may succeed.

Treatment.—As fetal mortality is decreased by better obstetric practices, we find the common causes of death slowly approaching a minimum, while the uncommon causes become more prominent in percentage of the total. In the case of breech presentation, we have learned from experience the many precautions which must be taken, and not a few problems which are encountered. Now we have a relatively recently described finding associated with breech which very appreciably alters prognosis for the baby. Among accidents listed as happening to the baby in hyperextension are transection of the spinal cord, dislocation of cervical vertebrae, and dislocation of the tibia on the femur.

A tabulation of percentage occurrence of these accidents cannot be made at present because too few cases have been observed, but it is easy to see that they are of serious import for the baby, and among the cases tabulated the average of the difficulties is high.

The abnormality of hyperextension would doubtless be found more frequently if routine x-rays were used in all breech presentations, and indeed this practice has much else to commend it. Reis and DeCosta have proposed a descriptive terminology in labeling breech presentation. They would add a statement concerning flection, extension, or hyperextension of the arms, legs, spine, or head to the usual diagnosis of breech right sacroanterior, left sacroanterior, etc. This suggestion is a good one, and in reporting routine roentgenograms of breech presentation the radiologist should as a matter of routine include all this information. When the diagnosis is made of breech presentation with deflexed head, the treatment is expectant and vaginal delivery with or without fundal pressure is anticipated. When the diagnosis is made of breech presentation with hyperextended head, after due attention to the possibility of spontaneous correction, the proper treatment is external manipulation looking toward flexing the head, or, failing this simple procedure, delivery by cesarean section prior to the onset of labor.

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EXTRAPERITONEAL CESAREAN SECTION VS. THE LAPARO-TRACHELOTOMY IN THE ERA OF MODERN ANTIBIOTIC THERAPY

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THERE is a choice of several operative procedures when abdominal delivery is necessary, namely, the classical, the low cervical, and the extraperitoneal cesarean section. On occasion it is necessary to combine the subtotal or total hysterectomy with cesarean section. Prior to the advent of penicillin and later-appearing antibiotics, the classical or low cervical cesarean section was the operation of choice in a noninfected case. The extraperitoneal section was reserved for those cases in which infection was potential or actual. Numerous excellent publications have advocated either the Norton extraperitoneal or the low cervical cesarean section; few have compared them.[1-10] None have compared the operations in groups in which the length of labor, the length of time the membranes have been ruptured, and the number of sterile and nonsterile vaginal examinations were similar, and, in addition, groups in which penicillin or one of the later-appearing antibiotics has been given preoperatively and postoperatively in adequate dosage. Now that these antibiotics are in common use it is probable that different criteria exist for the selection of the proper abdominal procedure. Statistics reported in this manuscript were compiled in an attempt to decide which operation is the procedure of choice now that penicillin and the later multiuseful antibiotics are available.

Results of Comparison of the Norton Extraperitoneal Section With the Laparotrachelotomy

Fifty-seven patients were operated upon by the Norton method and 79 by the low cervical section. All were operated upon since penicillin or one of the multiuseful antibiotics was in frequent use by this obstetrical department.

For comparison the patients were divided into three groups: those patients not in labor and with membranes intact, those in labor less than 30 hours, and those in labor more than 30 hours.

The Norton Extraperitoneal Section and Low Cervical Section Done Electively.—

The Norton extraperitoneal technique was employed in the abdominal delivery of 11 patients and upon 33 a low cervical cesarean section was performed, a ratio of 1 to 3. No patient was in labor. Of those operated upon by the extraperitoneal method, one received antibiotics prior to surgery and 8 received

antibiotics after delivery. Of those operated upon by the low cervical technique, 2 received antibiotics before delivery and 24 after delivery. Both groups were given approximately equal and adequate antibiotic therapy.

The two groups are proportionately similar in reference to the following: The patients were not in labor and membranes were intact (except for one case), the receiving of antibiotic therapy pre- and postoperatively and the number of sterile pelvic examinations were equal. There was no significant temperature elevation prior to surgery in either group.
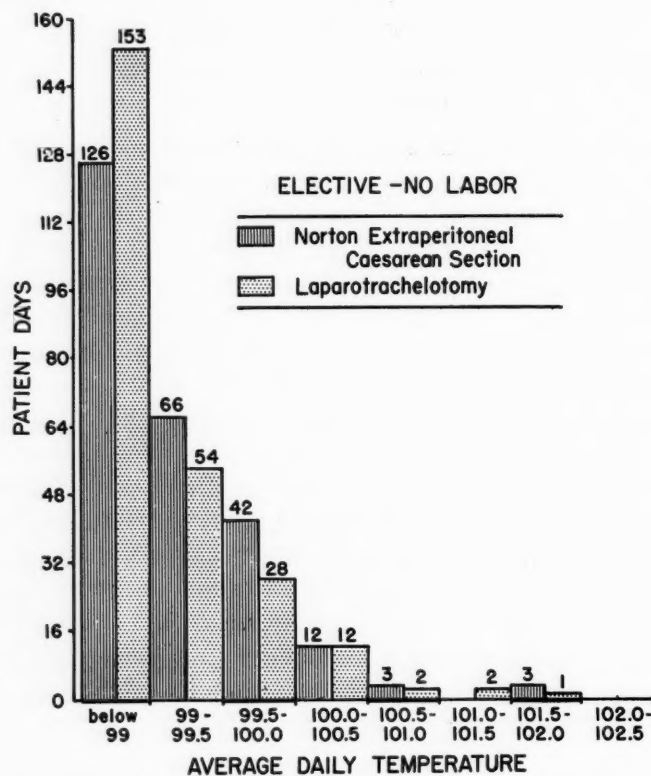
Fig. 1.

There was probably slightly more fever following the extraperitoneal than the low cervical section (Fig. 1). The elective extraperitoneal requires less time to accomplish than the low section done electively. There were no complications during the extraperitoneal operation; there were 3 instances of hemorrhage during the low cervical operation. Three patients operated upon by the Norton method developed a slight serous discharge at the site of the drain. This discharge lasted about 7 days. Those patients in whom a drain was not used had no drainage from the wound. Of those operated upon by the low cervical technique, 3 developed abdominal distention and 1 postpartum hemorrhage. The average length of postoperative hospitalization per patient was 7.5 days following the Norton section and 6.6 days following the low cervical section.

The Norton Extraperitoneal and the Low Cervical Cesarean Section Performed Upon Those Patients in Labor.—

There were 30 patients upon whom the extraperitoneal cesarean section was done in labor and an equal number upon whom the low cervical operation was performed. Most of the patients in both groups were given antibiotics after delivery. Seventeen patients operated upon by the Norton technique and 7 patients operated upon by the low cervical technique received antibiotics preoperatively. The average number of patients subjected to a sterile pelvic examination was similar in each group, 0.53 per patient and 0.43 per patient.
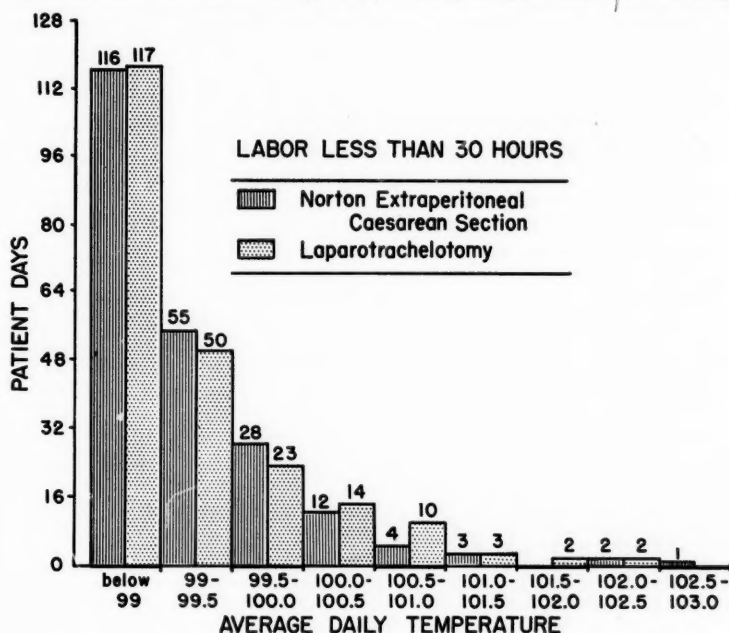
Fig. 2.

In no case was labor over 28 hours. Labor averaged 4½ hours longer and membranes were ruptured on the average of 5 hours longer in each patient ultimately operated upon by the low cervical technique. There was no significant temperature elevation prior to operation in either group but there is a slight increase in the postoperative fever in those patients subjected to the low cervical cesarean section (Fig. 2). Extension of the uterine incision occurred 5 times during the Norton operation and 3 times during low cervical cesarean section. One patient had profuse hemorrhage during operation and this occurred during the low cervical procedure. Postoperatively, abdominal distention was noted in 2 patients following the Norton section and in 6 patients following the low cervical section.

Five patients had slight drainage from the site of the drain and 4 developed a very mild wound infection in this area following the Norton section; none of the patients operated upon by the Norton technique developed this complication when the wound was not drained. One patient had wound separation and one developed wound infection following the low cervical sec-

tion. The average length of postoperative hospitalization per patient was 7.4 days following the Norton section and 6.8 days following the low cervical operation.

The Norton Extraperitoneal Section and the Low Cervical Section Performed in Patients in Labor More Than 30 Hours.—

This group comprises 16 patients operated upon by the extraperitoneal technique and 16 by the low cervical method. The number of patients in each group given antibiotics preoperatively and postoperatively is approximately equal. One patient in each group had a nonsterile vaginal examination before admission to the hospital. Membranes were ruptured on the average 5 hours longer and labor averaged 7.4 hours longer in each patient who was operated upon by the Norton technique. One patient went into shock from blood loss and one lost over 500 c.c. of blood during the Norton operation. Two patients went into shock from blood loss and 4 lost over 500 c.c. of blood during the low cervical operation. Two patients developed postpartum hemorrhage following the low cervical operation. In 3 instances an extension downward of the uterine incision occurred during the Norton operation. There was no incidence of extension of the uterine incision when the low cervical technique was employed. Postoperative fever was less following the Norton than the low cervical cesarean section (Fig. 3). There were 1 death and 1 case of respiratory arrest. The death and the temporary respiratory arrest were due to faulty technique of administration and excessive dosage of spinal anesthesia. The average length of postoperative hospitalization per patient was 7.5 days following either type of operation.

Method of Graph Construction

The temperature readings for each postoperative day were averaged for each patient, thus making one recording per postoperative hospital day for each patient. If the postoperative hospitalization of the patients operated upon by the Norton technique was equal to the postoperative hospitalization of those patients upon whom the low cervical section was performed, the graphs could be made without change. This situation existed in the prolonged labor group. (See Fig. 3.) The average length of postoperative hospitalization in this group was 7½ days.

The total days of postoperative hospitalization of the patients in labor less than 30 hours and upon whom a low cervical section was performed was 16 days less than of those patients operated upon by the Norton technique. It was necessary to assume that these 16 days, during which these patients were in their homes, represented days during which the average daily temperature did not exceed 99° F. Therefore, the figure 16 was added to the portion of the graph representing temperature below 99° F. in the low cervical group. Thus if some error in the graph exists, it represents the low cervical section as having slightly less temperature elevation than the actual.

The greatest chance for error exists in the graph entitled Fig. 1. Eleven patients were operated upon by the Norton technique and 33 by the low cervical method. In order to make the figures comparable it was necessary to

multiply the figures obtained by the Norton section by 3. Thus an equivalent of 33 patients in each group was acquired. The number thus computed for the total days of postoperative hospitalization following the Norton section was 34 days more than in the patients operated upon by the low cervical method. In consequence, the figure 34 was added to the portion of the graph representing temperature below 99° F. in the low cervical group. Some error in this graph is probable and it represents slightly less temperature elevation with the low cervical section than the actual.
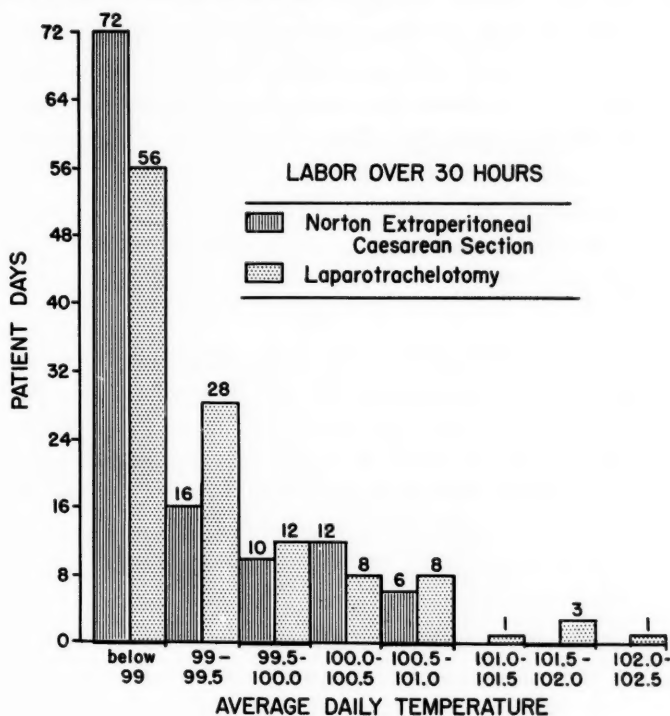
Fig. 3.

Comment

The classical cesarean section has fallen into ill repute due to the fact that the uterine scar ruptures more readily during pregnancy and during labor.[11-15] The rupture of the classical cesarean section scar is likely to be "explosive" in nature causing a grave prognosis to the infant.[12] Some skilled obstetricians still employ the classical section on occasion when confronted with a transverse lie; it is preferable to make the tranverse low cervical incision and extend it cephalad only after a reasonable attempt has failed to deliver the infant through the incision.

Since the advent of antibiotics, the low cervical cesarean section has gained in popularity at the expense of the extraperitoneal section and in many large institutions the latter operation has fallen into disuse.[2, 3, 5, 16, 17] Whether this is justifiable has been a moot question. It is instructive to review the results of these 2 procedures performed under similar circumstances.

The Norton Vs. the Low Cervical Section Performed Electively.—

It is necessary to employ blunt dissection more frequently and traumatize more tissue while performing the Norton extraperitoneal section than when performing the low cervical operation! This is an objection of consequence.

There is less abdominal distention and the incidence of severe hemorrhage during and after the operation is less when the Norton section is employed.

As a clinical observation there has been less operative and postoperative bleeding from the low cervical section since the adoption of the technique described by Marshall. Briefly, in this technique the incision into the lower cervix is extended by a strong pull with the index finger of either hand. Although bleeding is probably reduced by this method, it has caused extensive cervical laceration. This technique was not employed in any of the operations reported in this paper.

There is less chance of formation of postoperative adhesions within the peritoneal cavity following the extraperitoneal operation.

In an elective operation it is not necessary or advisable to make use of a drain.

In the absence of maternal or fetal distress there is no cogent reason why the elective extraperitoneal section should not be employed. However, the low cervical cesarean section is the operation of choice when performed upon a patient not in labor. This is based upon the increased traumatization to tissue during the Norton section and the time and labor required to prepare the patient and operating room paraphernalia (Table I, *A*).

The Norton Extraperitoneal Vs. the Low Cervical Section Performed Upon Patients in Labor.—

This group consisted collectively of 60 patients. The patients operated upon by the Norton section had the greatest chance of becoming infected preoperatively for membranes were ruptured on the average 5 hours longer and labor averaged 4½ hours longer than in the patients eventually operated upon by the low cervical method. In spite of this there is slightly less postoperative fever following the Norton operation (Fig. 2). As previously stated, if error exists in the graph, it represents the low cervical section as having slightly less morbidity than the actual. The difference in the postoperative fever is not enough to be of great importance.

The complication during operation common to the extraperitoneal section performed after a period of labor is extension of the uterine incision caudad. After labor the lower segment of the cervix is thinned and tears readily, especially if the fetal head is molded excessively and wedged into the pelvis and it becomes necessary to pry the fetal head toward the body of the uterus. In 5 instances during the Norton section there was extension of the uterine incision and in one case the extension reached the external cervical os. Because the extension occurs downward, exposure of the tear is difficult and hence repair may be tedious and time consuming. There were 3 incidences of extension of the uterine incision during the low cervical operation. The extraperitoneal cesarean section may be repeated during any following pregnancy, but then is more

TABLE I. SALIENT FACTS* RESPONSIBLE FOR SELECTION OF THE OPERATION OF CHOICE

FACTORS IN FAVOR OF THE NORTON EXTRAPERITONEAL SECTION	FACTORS IN FAVOR OF THE LOW CERVICAL CESAREAN SECTION
A. Elective Cesarean Section.—	
1. Less bleeding during operation	1. Less tissue traumatized
2. Less incidence of postoperative hemorrhage	2. Less time required to prepare patient and operating room
3. Less chance of forming intra-abdominal adhesions	3. Perhaps less postoperative fever
4. Less postoperative abdominal distention	

Operation of choice: Low cervical cesarean section

B. Cesarean Section Done Before Labor Has Progressed 30 Hours.—	
1. Less bleeding during operation	1. Less tissue traumatized
2. Slightly less postoperative fever	2. Less time required to prepare patient and operating room
3. Less incidence of postoperative hemorrhage	3. Less incidence of extension of uterine incision
4. Less postoperative abdominal distention	
5. Less chance of forming intra-abdominal adhesions	

Operation of choice: Low cervical cesarean section, presupposing that the patient is not infected

C. Cesarean Section After Labor Has Progressed More Than 30 Hours.—	
1. Less postoperative fever	1. Less tissue traumatized
2. Less postoperative abdominal distention	2. Less incidence of extension of uterine incision
3. Less bleeding during operation	3. Less time required to prepare patient and operating room
4. Less incidence of postoperative hemorrhage	
5. Less chance of forming intra-abdominal adhesions	

Operation of choice: Norton extraperitoneal section

*An attempt has been made to list the various factors in the order of importance.

difficult and time consuming. If a drain is used, there is an incidence of mild infection about the site of the wound. If the drain is omitted, this complication is circumvented. One patient had severe hemorrhage during operation and this occurred during the low cervical section. Abdominal distention is more frequent following the low cervical section than following the Norton section. The low cervical technique appears to be the operation of choice when performed upon the patient who has been in labor less than 30 hours and in whom infection is not potential or actual. Although more factors are in favor of the Norton section, the difference in the results obtained with the two operations are not significant enough to overcome the fact that less tissue is traumatized, that it is easier to prepare the patient and operating room for operation, and there is less incidence of extension of the uterine incision when the low cervical cesarean section is employed (Table I, B).

The Norton Extraperitoneal Section Vs. the Low Cervical Section Performed on Patients in Labor Over 30 Hours.—

In this group consisting collectively of 32 patients, membranes were ruptured on the average 5 hours longer and labor averaged 7½ hours longer in each patient who was operated upon by the Norton method. This 7½ hours is

probably more significant than similar prolongation in the group in labor less than 30 hours. For example, the shortest labor in the group just mentioned was 2 hours. If 7½ hours is added to that labor, the total labor would be 9½ hours but if 7½ hours is added to 31 hours of labor (shortest labor in prolonged labor group is 31 hours, longest labor 107 hours) the total is 38½ hours. It is probable that the addition of labor in the latter case would be more likely to produce greater detrimental effect, fetal and maternal. In spite of this, there is less fever after the Norton operation performed after 30 hours of labor than following the low cervical procedure.

Groups of patients considered in this paper are small, being 44, 60, and 32, respectively. The smaller the group the less significant the figures become. However, many factors are common to each of the three groups, thus lending credence to the statistics for any one group.

The complications during operation again reveal that during the Norton section the extension of the incision is more frequent than during the low cervical section while blood loss is greater during the low cervical section. Two of the 16 patients operated upon by the low cervical method had postpartum hemorrhage. This does not necessarily incriminate the low cervical section for it is well known that postpartum hemorrhage due to uterine relaxation is prone to occur following prolonged labor.[18] It is advisable to place a drain in the incision after prolonged labor where the Norton technique is employed.

There was one case of respiratory arrest and one death; these were both due to improper dosage and technique of spinal anesthesia. The utmost effort is being made to prevent this catastrophic cause of mortality associated with cesarean section. Excluding this mortality, the operative and postoperative results were excellent in this group of seriously ill patients whether Norton or low cervical operation was performed. However, the Norton section is the operation of choice in patients subjected to prolonged labor for there is left little to be desired in the operative and postoperative course. It is almost miraculous that despite the length of labor not a single patient operated upon by the Norton technique developed a postoperative fever that averaged over 101° F. for a single day. Postoperative fever and abdominal distention are less following the Norton extraperitoneal section than following the low cervical operation. This is true despite adequate antibiotic therapy with the best antibiotics now available (Table I, C).

Summary

1. Seventy-nine patients were operated upon by the low cervical cesarean section and 57 patients were operated upon by the Norton extraperitoneal method. Adequate preoperative and postoperative antibiotic therapy with penicillin or the later-appearing antibiotics was given.

2. The patients were divided into three groups, those not in labor and with membranes intact, those in labor under 30 hours, and those in labor over 30 hours. Comparisons between the Norton extraperitoneal section and the low cervical cesarean section were made in regard to operative and postoperative complications and postoperative course.

Conclusions

The Norton extraperitoneal cesarean section is the abdominal operation of choice after a patient has been in labor 30 hours or more in spite of modern antibiotic therapy.

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ELECTIVE INDUCTION OF LABOR*

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IT IS our opinion that the elective induction of labor has a useful place in present-day obstetrics with advantages to both patient and doctor. If the procedure is applied to the proper patient at the proper time, no serious complications should result. As Eastman[1] points out in commenting on Hanley's[7] paper, "It is the abuse of the procedure, or its application to the wrong patient that is fraught with danger, not the procedure itself."

It should no longer be necessary to do this procedure secretively or with apologies to one's confreres or to the nursing staff, provided the cervix is "ripe," which means that the cervix is partially dilated and 50 per cent or more effaced; in addition, the vertex should be well in the pelvis, the pelvis normal, and the patient at or close to term.

The advantages to the patient who is a proper candidate for induction and who lives at a considerable distance from the hospital are obvious. It is these patients who often have to race to the hospital in a breakneck contest with time in which they occasionally fail. It gives both the patient and doctor greater peace of mind knowing that they can plan a particular delivery without detriment to the mother or her offspring. It also lightens the load for the busy obstetrician who is often called upon to exercise his best judgment when he is physically at low ebb.

When the patient is admitted to the hospital, the vulva is shaved, scrubbed, and prepared for a sterile vaginal examination in the labor room. The operator scrubs in the same way as he would for a delivery, puts on sterile gloves, and examines the patient. If the cervix is at least 1 to 2 cm. dilated, 50 per cent or more effaced, and the vertex well in the pelvis, the membranes are ruptured with an ordinary dressing forceps. We usually strip the membranes from the cervix and lower uterine segment before rupturing them, and then allow a considerable amount of fluid to escape. We feel that stripping of the membranes shortens the latent period before contractions set in. A small dose of Seconal (1½ grains) is frequently given to the patient on admission. After the membranes have been ruptured the patient is given a soapsuds enema. Pituitrin, ½ to 1 minim doses, repeated every 20 to 30 minutes, has frequently been used in the hope of shortening the latent period. In recent years, some of us have used intravenous Pitocin (3 minims to 500 c.c. of 5 per cent glucose in water) for the same purpose.

If the cervix, on vaginal examination, is found to be unsuitable for induction and an error in judgment has apparently been made in selecting a given case for the procedure, the membranes are not ruptured; the patient is frankly told that she is not a suitable candidate for the procedure and she is sent home.

In 1947, Grier[2] reported the elective induction of labor in a carefully controlled group of 129 cases. These represented 10 per cent of his total deliveries. All inductions were done with the consent of the patient, and in each one conditions were right for the procedure. There was only one failure. Grier postulates the following prerequisites for the procedure:

1. There should be no cephalopelvic disproportion.
2. The baby should be mature and preferably in a vertex presentation.
3. The fetal head should be engaged or dipping well into the pelvis.
4. The cervix should be soft, partially effaced, and at least 1 cm. dilated.

If labor does not ensue in 2 hours, he suggests small intramuscular doses of Pitocin given every 30 to 60 minutes. Usually, two doses are sufficient. He reports no instances of uterine tetany, a lower morbidity than for the non-induced cases, and a fetal loss of two babies, both unrelated to the procedure. The duration of labor is also recorded as shorter than usual.

Previously Reported Experience With Elective Induction

Grier makes the observation that the more effacement and dilatation there are to begin with, the shorter the latent period and the more rapid the labor. Similar conditions are said to obtain with a vertex that is lower than a minus one station. He concludes that the method is highly successful in properly selected cases. The low maternal morbidity and fetal mortality show it to be a safe procedure in properly selected women in whom labor is imminent.

In 1948, Wallace and Antony[3] of the Brooklyn Hospital reported on 359 cases of elective induction of labor at term. These authors first used this procedure on patients who lived a considerable distance from the hospital. At first they applied it to both primiparas and multiparas, but after a short experience with a small group of primiparous women who had a rather long latent period, they used it only in multiparas. Their report is therefore largely based on its use in multiparas.

Their average latent period was 3 hours, 40 minutes. Pitocin was used in 13.8 per cent of the cases. The average duration of the labor was 4 hours, 35 minutes, as compared to 10 hours, 15 minutes in a similar series of control multiparas. There was no maternal mortality, no increased morbidity, and only one fetal loss due to a congenital anomaly.

They recommend that elective induction be limited to multiparas and consider it a safe procedure if applied under the proper conditions. They stress that its greatest hazard is in its misapplication. Among the advantages mentioned by Wallace and Antony are these: First, that the patient, in the hospital before the onset of labor, may be better prepared for anesthesia by having her stomach emptied. Second, analgesia may be begun much earlier. They particularly recommend it in times of emergency when transportation facilities are disrupted.

Sage,[4] in one of the 1948 issues of the *Journal of the Omaha Mid-West Clinical Society*, discusses the medical, hormonal, and mechanical induction of labor. He is strongly in favor of the mechanical method. He advises stripping and then rupturing the membranes when the cervix is effaced, 3 cm. dilated, and the vertex well engaged. He advises intranasal Pituitrin if labor does not ensue in four hours. Sage briefly mentions several reports of elective induction and we feel a brief review of these is pertinent to our discussion.

In 1940, Keettel, Diddle, and Plass,[4a] of the University of Iowa, presented a study comparing 1,000 patients with late spontaneous rupture of the membranes with another 1,000 patients who had artificial rupture of the membranes at term. They concluded that artificial rupture of the membranes does not significantly alter the birth process, nor affect the prognosis for mother or child. Intrapartum infections and prolapsed cord were twice as frequent in the induced series, but there were no serious infections, and persistent fevers were as common in one group as in the other.

In 1944, Gillett[4b] reported 1,000 elective inductions at term in normal obstetrical patients. One hundred per cent were in labor within 12 hours. The average latent period was one hour. The average duration of labor in primiparas was 6 hours, in multiparas, 3 hours. There were no cases of fetal distress and no cases of prolapsed cord. There was no maternal mortality. Fetal mortality was 0.8 per cent.

In 1939, Greenhill[4c] put the question of the use of pituitary extract to induce labor to the Department of Legal Medicine of the American Medical Association and submitted the opinions of Dr. W. C. Woodword, director of that department. Greenhill wonders how many physicians realize that when they induce labor by rupture of the membranes, or by use of pituitary extract, for their own or their patient's convenience, they are exposing themselves to both civil and possible criminal action. The following legal opinions are quoted: "As far as civil liability is concerned, the question would have to be decided by the testimony of experts in the community testifying as to whether such practice in the individual case represented due negligence, ordinary knowledge and skill, and best judgment. In addition, no professional standard anywhere or at any time could justify a physician in doing anything that would jeopardize the life and well being of mother or infant solely for the physician's convenience. Even the consent of the father and mother does not absolve the physician if there is material danger to mother or child."

"The use of pituitary extract or other agency to induce labor may or may not come into the field of criminal practice, depending on the laws of the different states."

In a recent communication with Dr. Greenhill,[5] he informs us that, as far as he knows, there has been no change in the legal aspects of the problem.

In 1938, a committee of the Central Association of Obstetricians and Gynecologists[4d] sent out a questionnaire on elective induction and received 125 replies. This group delivered 13,891 patients and induced labor in 1,531 (11 per cent); 91 per cent of the inductions were successful. Prolapsed cord oc-

curred in 30 cases (0.3 per cent). The uncorrected fetal mortality was 1.6 per cent.

In his summary, Sage states that the frequency with which labor is being induced today by artificial rupture of the membranes constitutes one of the notable trends in modern obstetrics. The criteria for inductions must be considered fully, and he emphasizes that when labor is induced electively, the physician becomes responsible for any and all complications that may follow. (Through a recent communication[6] with the Division of Legal Medicine of the American Medical Association we are informed that if anything goes wrong as the result of the procedure done, the physician may be held fully liable. We are also advised to have the written specific consent of both mother and father before doing the procedure. The particular question raised and the answers received are the opinion of the legal staff and they admit that they know of no court decisions involving the precise question which we raised.)

In 1951, Hanley[7] of Los Angeles reported 653 cases handled by elective induction. All were private cases and represent 10 per cent of his total deliveries. There was no maternal mortality. The gross fetal mortality was 1.2 per cent and after correcting for anomalies, it was reduced to 0.5 per cent. No prolapse of the cord occurred. The average length of labor in the group with induced labor was much shorter than that of the group with noninduced labor. There were no apparent anatomical injuries in the induction group compared to the noninduction group. He states that the sole moral and legal responsibility rests upon the operator. It is Hanley's belief that, when labor is imminent, as determined by the criteria outlined, almost any stimulus will initiate uterine contractions. Amniotomy, however, will result in universal success. He concludes that elective induction does not increase the incidence of dystocia or obstetrical emergencies if the conditions outlined are fulfilled.

Presentation of Material

The present report deals with 657 private cases of the two authors and of Dr. M. M. Shir and Dr. T. T. Rose. These occurred from 1943 to 1951, and roughly represent 10 per cent of the patients delivered by this group during these nine years. There were 100 primiparas and 557 multiparas.

The criteria used to determine the patients suitable for elective induction were as follows: (a) patient at or close to term; (b) pelvis normal; (c) presenting part well in the pelvis; (d) presenting part preferably a vertex; (e) cervix at least 50 per cent effaced and at least 1 to 2 cm. dilated.

All of these patients had amniotomy performed under strictly aseptic conditions as outlined in the earlier part of this paper. About half of them (335) received Pituitrin after the membranes were ruptured.

The results of the treatment of these cases are given in the accompanying tables and figures, and may be briefly stated as follows:

A. Reference to Table I and Fig. 1 shows clearly that as the cervical dilatation at time of induction increases, the latent period decreases.

TABLE I. EFFECT OF CERVICAL DILATATION ON LATENT PERIOD

DILATATION	LATENT PERIOD (MINUTES)	PRIMIPARAS (100)		MULTIPARAS (557)		TOTAL (657)		CUMULATIVE PERCENTAGE
1 cm.	0 – 30	1		10		11		9
	31 – 60	8		16		24		28
	61 – 120	12		34		46		64
	121 – 240	3		27		30		88
	Over 240	4	(28)	11	(98)	15	(126)	100
2 cm.	0 – 30	7		59		66		21
	31 – 60	9		80		89		49
	61 – 120	16		80		96		79
	121 – 240	4		44		48		94
	Over 240	3	(39)	16	(279)	19	(318)	100
3 cm.	0 – 30	10		49		59		40
	31 – 60	7		43		50		74
	61 – 120	5		21		26		91
	121 – 240	3		6		9		97
	Over 240	2	(27)	2	(121)	4	(148)	100
4 cm.	0 – 30	1		17		18		55
	31 – 60	5		5		10		85
	61 – 120	0		4		4		97
	121 – 240	0		1		1		100
	Over 240	0	(6)	0	(27)	0	(33)	
Unknown					(32)		(32)	

TABLE II. EFFECT OF CERVICAL DILATATION ON LENGTH OF LABOR

DILATATION	LENGTH OF LABOR (HOURS)	PRIMIPARAS (100)		MULTIPARAS (557)		TOTAL (657)		CUMULATIVE PERCENTAGE
1 cm.	0 – 6	8		71		79		63
	6+ – 12	9		20		29		86
	12+ – 24	6		6		12		96
	Over 24	5	(28)	1	(98)	6	(126)	100
2 cm.	0 – 6	17		220		237		74
	6+ – 12	20		42		62		93
	12+ – 24	2		16		18		99
	Over 24	0	(39)	1	(279)	1	(318)	100
3 cm.	0 – 6	18		108		126		85
	6+ – 12	6		9		15		95
	12+ – 24	3		4		7		100
	Over 24	0	(27)	0	(121)	0	(148)	
4 cm.	0 – 6	2		25		27		81
	6+ – 12	4		2		6		100
	12+ – 24	0		0		0		
	Over 24	0	(6)	0	(27)	0	(33)	
Unknown					(32)		(32)	

TABLE III. EFFECT OF PITUITRIN ON LATENT PERIOD

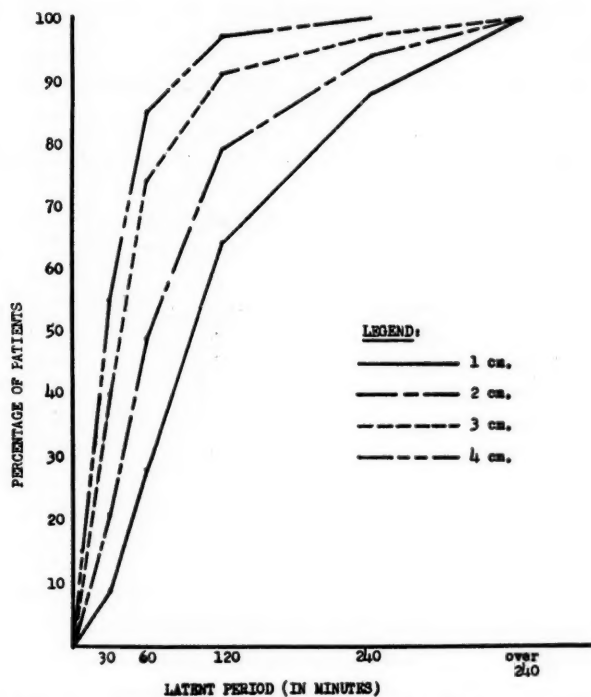|	LATENT PERIOD (MINUTES)	PRIMIPARAS (100)		MULTIPARAS (557)		TOTAL (657)		CUMULATIVE PERCENTAGE
No Pituitrin	0 – 30	12		84		96		33
	31 – 60	16		61		77		59
	61 – 120	16		58		74		84
	121 – 240	5		21		26		92
	Over 240	7	(56)	14	(238)	21	(294)	100
Pituitrin	0 – 30	7		55		62		19
	31 – 60	13		83		96		47
	61 – 120	16		82		98		75
	121 – 240	5		57		62		94
	Over 240	2	(43)	15	(292)	17	(335)	100
Unknown			(1)		(27)		(28)	

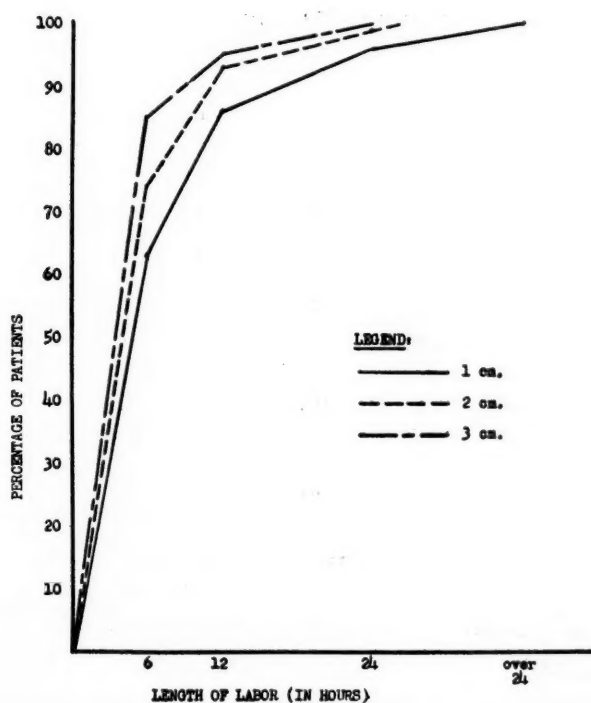Fig. 1.—Effect of cervical dilatation on latent period.

Fig. 2.—Effect of cervical dilatation on length of labor.

B. As the cervical dilatation increases, the length of labor decreases (Table II, Fig. 2).

C. Our results show that Pituitrin does not significantly alter the latent period (Table III, Fig. 3).

D. Pituitrin had no effect on the duration of labor (Table IV and Fig. 4).

TABLE IV. EFFECT OF PITUITRIN ON LENGTH OF LABOR

	LENGTH OF LABOR (HOURS)	PRIMIPARAS (100)		MULTIPARAS (557)		TOTAL (657)		CUMULATIVE PERCENTAGE
No Pitui-trin	0 – 6	29		197		226		76
	6+ – 12	17		31		48		92
	12+ – 24	8		9		17		98
	Over 24	2	(56)	1	(238)	3	(294)	100
Pituitrin	0 – 6	17		232		249		74
	6+ – 12	19		42		61		92
	12+ – 24	4		17		21		99
	Over 24	3	(43)	1	(292)	4	(335)	100
Unknown			(1)		(27)		(28)	

E. Our results (Table V and Fig. 5) here indicate that the shorter the latent period, the shorter the duration of labor.

TABLE V. EFFECT OF LATENT PERIOD ON LENGTH OF LABOR

LATENT PERIOD	LENGTH OF LABOR (HOURS)	PRIMIPARAS (100)		MULTIPARAS (557)		TOTAL (657)		CUMULATIVE PERCENTAGE
0 to 30 minutes	0 – 6	14		140		154		90
	6+ – 12	4		8		12		97
	12+ – 24	1		3		4		100
	Over 24	0	(19)	0	(151)	0	(170)	
31 to 60 minutes	0 – 6	13		122		135		75
	6+ – 12	10		21		31		92
	12+ – 24	4		6		10		98
	Over 24	2	(29)	1	(150)	3	(179)	100
61 to 120 minutes	0 – 6	11		111		122		69
	6+ – 12	17		24		41		92
	12+ – 24	4		9		13		99
	Over 24	1	(33)	0	(144)	1	(177)	100
121 to 240 minutes	0 – 6	6		60		66		72
	6+ – 12	3		13		16		90
	12+ – 24	1		7		8		99
	Over 24	0	(10)	1	(81)	1	(91)	100
Over 240 minutes	0 – 6	3		20		23		58
	6+ – 12	2		9		11		86
	12+ – 24	2		2		4		96
	Over 24	2	(9)	0	(31)	2	(40)	100

TABLE VI. METHOD OF DELIVERY

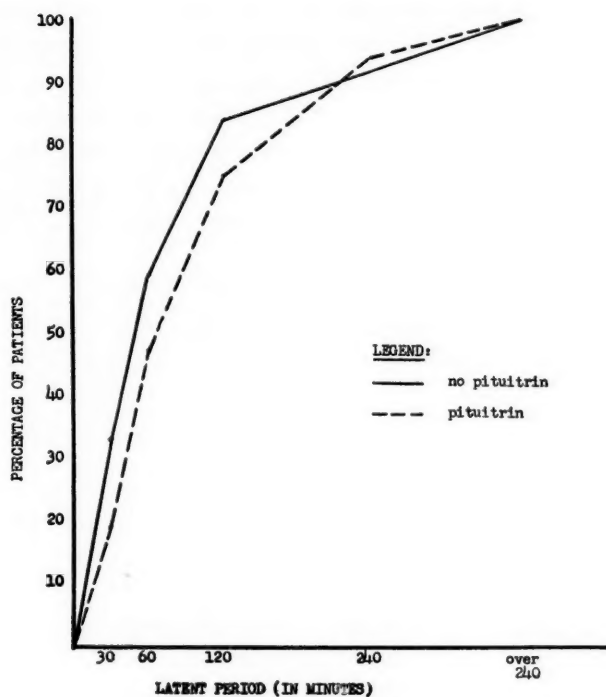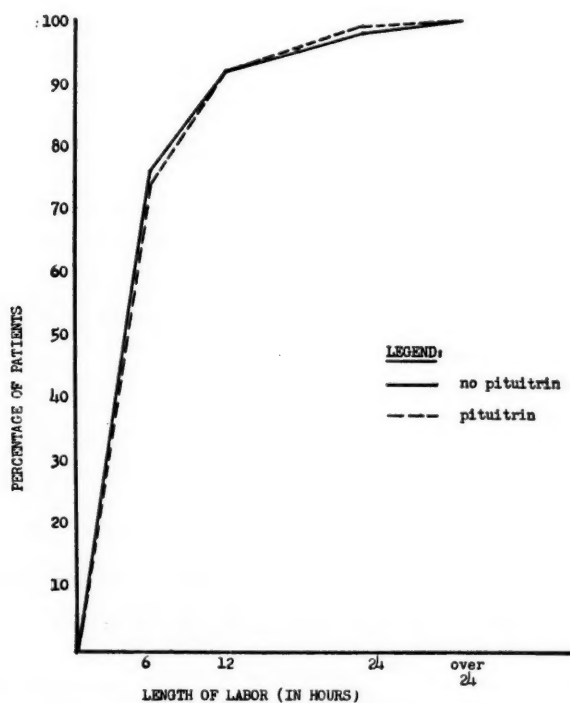|		
Spontaneous	511	(77.7%)
Low forceps	115	(17.5%)
Midforceps	22	(3.3%)
Breech	6	(1.0%)
Version	2	(0.3%)
Section	1	(0.2%)
Total	657	

Fig. 3.—Effect of Pituitrin on latent period.

Fig. 4.—Effect of Pituitrin on length of labor.

F. Over 95 per cent of our patients had either a spontaneous or low forceps delivery (Table VI). This corresponds closely to the method of delivery generally prevalent on our service. Our incidence of 3.3 per cent midforceps is no higher than our general incidence of midforceps delivery.

G. It is significant that as the duration of labor increases, the percentage of spontaneous deliveries decreases and, conversely, as the duration of labor increases, the incidence of midforceps increases (Table VII, Fig. 6).

TABLE VII. EFFECT OF DURATION OF LABOR ON TYPE OF DELIVERY

LENGTH OF LABOR	TYPE OF DELIVERY	PRIMIPARAS (100)	MULTIPARAS (557)	TOTAL (657)	PERCENTAGE
Under 6 hours	Spontaneous	28	381	409	82
	Low forceps	16	59	75	15
	Midforceps	2	9	11	2
	Breech extraction	1	4	5	1
	Version	0	0	0	
	Cesarean section	0 (47)	0 (453)	0 (500)	
6 to 12 hours	Spontaneous	13	65	78	70
	Low forceps	20	7	27	24
	Midforceps	3	1	4	4
	Breech extraction	0	1	1	1
	Version	0	1	1	1
	Cesarean section	0 (36)	0 (75)	0 (111)	
12 to 24 hours	Spontaneous	1	20	21	54
	Low forceps	8	4	12	31
	Midforceps	3	2	5	13
	Breech extraction	0	0	0	
	Version	0	1	1	2
	Cesarean section	0 (12)	0 (27)	0 (39)	
Over 24 hours	Spontaneous	3	0	3	43
	Low forceps	0	1	1	14
	Midforceps	2	0	2	29
	Breech extraction	0	0	0	
	Version	0	0	0	
	Cesarean section	0 (5)	1 (2)	1 (7)	14

H. There was one stillbirth which occurred in a multipara with a breech presentation; this baby died in labor before delivery (Table VIII).

TABLE VIII. FETAL RESULTS AND COMPLICATIONS

Stillbirths		1
Neonatal deaths		2
Neonatal deaths corrected (congenital cardiac disease)		1
Fetal morbidity		2
a. Possible cerebral injury	1	
b. Erythroblastosis	1	
Babies over 9 pounds		5
Twins		5 sets

There were two neonatal deaths; one infant had congenital cardiac disease, the other was a large baby in a multipara with a brow presentation, delivered by version and breech extraction.

I. There was no maternal mortality. Seven patients had temperature morbidity. Thirteen patients had a blood loss of over 500 c.c.; of these, 10 had had Pituitrin as part of their induction (Table IX).
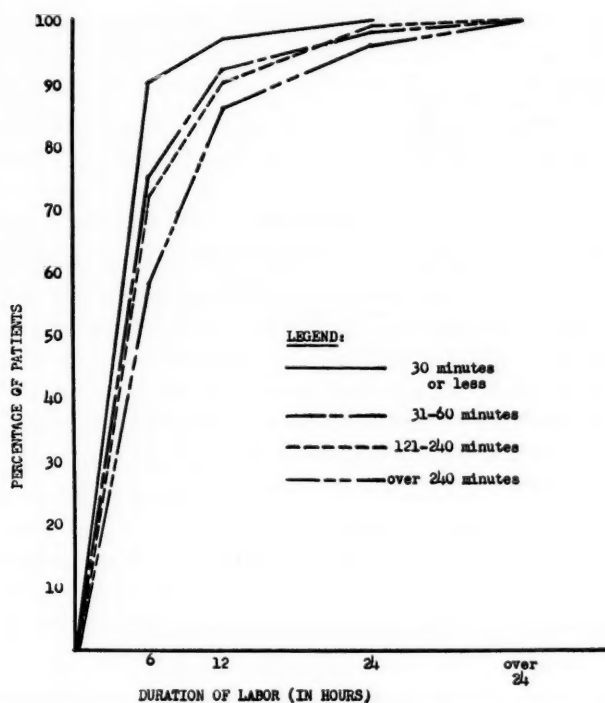
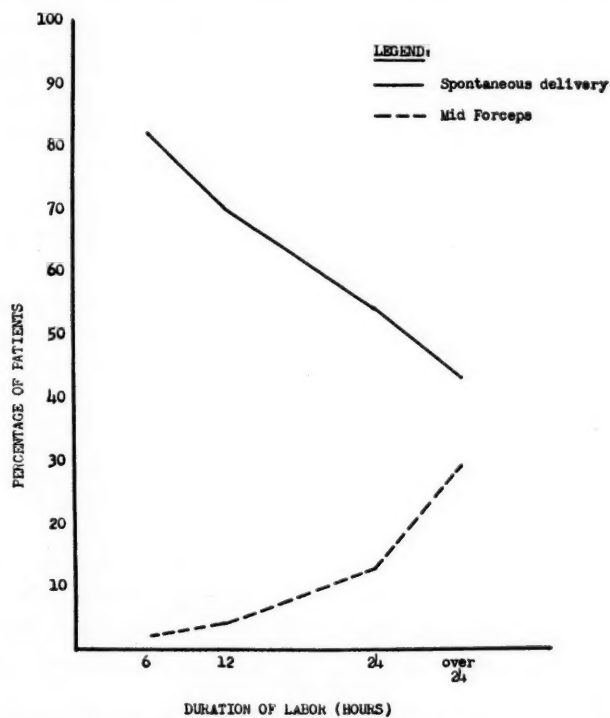Fig. 5.—Relation between latent period and duration of labor.

Fig. 6.—Relation between duration of labor and type of delivery.

TABLE IX. MATERNAL RESULTS

Mortality		0
Morbidity		7
Blood loss over 500 c.c.		13
With Pituitrin	10	
Without Pituitrin	3	

Comment

From the tables and graphs presented above, it is quite obvious that the greater the degree of cervical dilatation before the membranes are ruptured, the shorter the latent period and the labor. This is equally true for primiparas and multiparas: 81 per cent of the primiparas and 80 per cent of the multiparas were in labor within two hours of rupture of the membranes regardless of the degree of dilatation. As regards the duration of labor, 45 per cent of the primiparas were delivered within 6 hours and 84 per cent within 12 hours. In the multiparous group, 76 per cent were delivered within 6 hours and 93 per cent within 12 hours.

Pituitrin, whether used in small intramuscular doses or intravenously, did not seem to shorten the latent period or the duration of labor.

A direct relationship is shown between the length of the latent period and the duration of labor. This is to be expected because the woman in whom labor is imminent and in whom all the conditions for induction are favorable should go into labor promptly and have a short labor. The reverse is also true and usually indicates that the choice for induction is not a good one.

The maternal and fetal results were not seriously affected by the procedure. There was no maternal mortality; only 7 patients had morbidity in terms of temperature, and 13 had a blood loss of over 500 c.c. Of these 13, 10 had been given pituitary extract. Since we have demonstrated that Pituitrin does not shorten the latent period or the duration of labor in our cases, we would advise against its use in cases where membranes are ruptured electively for the induction of labor. This would probably decrease the 2 per cent incidence of postpartum hemorrhage.

The loss of three babies, one stillborn and two in the neonatal period, gives a gross fetal mortality of 0.45 per cent. When this is corrected for one baby with congenital heart disease, this figure is reduced to 0.3 per cent.

Summary and Conclusions

1. A series of 657 normal private obstetrical patients (100 primiparas, 557 multiparas) at or near term, with elective induction of labor by rupture of membranes, is presented.

2. These roughly represent 10 per cent of the deliveries by this group at the Jewish Hospital of Brooklyn from 1943 through 1951.

3. Our tables and figures show that the greater the degree of cervical dilatation at the time of induction, the shorter the latent period, and the shorter the labor.

4. A direct relationship is shown to exist between the latent period and the duration of labor; a short latent period is usually followed by a short labor, and a long one by a long labor.

5. Pituitrin, intramuscularly or intravenously, had no significant effect on either the latent period or the duration of labor.

6. Since Pituitrin was used in 10 out of 13 cases in which there was a blood loss of over 500 c.c., we advise against its use in elective induction.

7. The methods of delivery in this series show no significant variations from the usual.

8. No cases of prolapsed cord occurred.

9. The fetal mortality (stillbirths and neonatal deaths) was 0.45 per cent uncorrected and 0.3 per cent corrected.

10. The maternal morbidity (in terms of temperature) was 1 per cent; the maternal mortality was 0 and the incidence of postpartum hemorrhage was 2 per cent.

11. We feel that, in properly selected cases, using the criteria outlined above, this procedure is safe for both mother and baby.

12. From a medicolegal point of view, however, the sole moral and legal responsibility rests upon the physician who practices this procedure; and when labor is electively induced, he becomes responsible for any and all complications that may ensue.

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AN APPRAISAL OF PATIENT TRAINING FOR CHILDBIRTH*

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THIS report on the practicability of labor training in the antepartum period is based on the comparative studies of 400 primiparous patients, one-half of whom were used as controls. The method of teaching and training was patterned after that of Dr. Grantly Dick Read[1] and the late Helen Heardman.[2]

The four classes of training were given at our private offices, except for a guided tour of the labor and delivery rooms at the Samaritan Hospital. Our classes were comprised of from 3 to 12 patients who were instructed by either of us or by one of our nurses. There were no clinic patients included in the studies, but we are frank to admit that, among the first group of 100 trainees, there were a few of very limited mental ability. This was unavoidable as we were desirous of obtaining an accurate appraisal of the training given to a consecutive series. The second series of 100, on the other hand, were selected patients, many of whom requested the training.

We were not by the bedsides of our labor patients throughout all of their labor, nor were more than a few constantly attended by one of our nurses while they were in labor. Frequent short visits were all the attention that our time could allow. The hospital nurses assigned to the labor and delivery rooms administered what medical or psychological care the patients received. We might add that at first there was only a feeble effort at cooperation with the plan on the part of the nurses in our maternity department. In two known instances there was definite opposition. Thus, you can understand that the ideals as set forth by the originator of the training, Dr. Read, were not carried out in this series of cases. Furthermore, we made no effort to assure our patients that their labor would be free from pain or that their babies would be born naturally without forceps or other assistance. With these facts in mind, it can readily be understood why we do not label this work "the Read technique" nor do we call it "natural childbirth." Such terminology, we think, would be misleading.

At the first class, our patients are told that the training adds one more chapter to the regular and usual antepartum care that we give to our patients and we emphasize that it does not presuppose that they will be required to have a birth without medical or surgical assistance, if such aid is desired by them and is consistent with their safety.

In most instances we did not allow multiparous patients to attend the classes for primiparas because we found that the questions and remarks of such patients were often not conducive to the proper psychological approach which we were endeavoring to instill in the mind of the primiparous woman. Another factor which contraindicates such mingling of the veteran patient with the novice is the well-known fact that all parous women have had a mental conditioning of tenseness, fear, and pain. We believe that this mal-conditioning requires a different technique than that which must be used for the inexperienced primiparous patient. Further, we did not allow the husbands to attend any of the classes because we thought that our discussions could be more personal and intimate and with less embarrasment to the sensitive mothers if both sexes were not mixed. However, all of the husbands were familiar with our plans and were at hand to comfort and console their wives during labor. Most of the patients were kept out of bed and out in the solarium with their husbands during the first stage of labor. This procedure was particularly necessary inasmuch as our hospital has not the space to provide for the isolation of each patient in a private labor room. As a result of such limitation, our trainees were occasionally frightened and made tense by the crying of another untrained patient in the same labor room.

Individual nursing attention was seldom given either to the trainees or to the controls, unless it so happened that the patient employed a private duty nurse of her own selection. Invariably that special duty nurse had little or no knowledge of the training methods or even much specialized knowledge of labor nursing.

As this report is based on the results of labor and delivery, we have not included any patients who were delivered by cesarean section. Only patients who attended all four of the training classes were included in this study. Our aim has been consistently to assess the merits of the procedure and in no way to paint a bright picture of any special technique, or to encourage our patients not to receive medical assistance. Apropos of this I might add that at times it became necessary for us to *urge* our patients to receive aid rather than refuse them analgesia.

In gathering the statistics for this report we would like to make it clear that the data were recorded by us at the time of the examination or treatment and in no instance was it subject to the trickeries of memory or to the varied interpretations of a number of untrained or relatively inexperienced observers.

There were no maternal deaths in either group and no neonatal losses that could be attributed to either the analgesia used, or the lack of its use. The incidence of asphyxia neonatorum is well known. Suffice it to say that the less the anesthesia or analgesia the lower the incidence of asphyxia.

Length of Labor

Length of labor in the trained group was 13.5 hours. The control group averaged 15.5 hours. It has been our practice to rupture the membranes during the middle or latter third of the first stage of labor. In some respects this may account for the relatively short labor of both groups.

Medication

The medication used to produce analgesia was rated in units of 1, 2, and 3. One unit is not adequate to produce sedation but does slightly decrease pain perception. The commonest medication used for this purpose was 40 or 60 mg. of Nisentil (1,3-dimethyl-4-phenyl-4-propionoxy-piperidine hydrochloride). The dosage of course varied with the weight of the patient and was never adequate to produce hypnosis. To the controls, the usual one-unit medication consisted of $1\frac{1}{2}$ grains of Nembutal with $\frac{1}{200}$ grain of scopolamine by mouth or $\frac{1}{8}$ grain of morphine with $\frac{1}{200}$ grain of scopolamine by injection. The two-unit medication in our series represented either a repetition of the single-unit medication or the use of 100 mg. of Demerol with $\frac{1}{200}$ grain of scopolamine. However, scopolamine was seldom used among the trainees unless it was their request that they should remember nothing of the second stage of labor and delivery. In a few instances $\frac{1}{6}$ grain of morphine was given without scopolamine as a two-unit medication. Three-unit dosage was adequate to produce hypnosis as well as complete amnesia and always consisted of scopolamine and Nembutal, Demerol, or morphine in varying dosage dependent on the weight of the patient.

There were 45 trainees who went through labor with no analgesic drugs of any kind; only 2 of the controls withstood labor without drugs (Table I).

TABLE I. SUMMARY OF MEDICATION USED

UNITS	TRAINEES	CONTROLS
None	45	2
One	61	41
Two	70	99
Three	24	58

One unit of analgesic drugs was given to 61 of the trainees and to 41 of the controls. Two units were given to 70 of the trainees and to 99 of the controls. Three units were given to 24 of the trainees and to 58 of the controls.

Types of Delivery

One hundred sixteen of the trainees delivered normally, 82 of the controls (Table II). Sixty-six of the trainees required low forceps, 113 of the controls. Eighteen of the trainees required medium forceps, 14 of the controls. There were no high forceps deliveries among the trainees and only one of the controls required this difficult operation.

TABLE II. TYPES OF DELIVERY

	TRAINEES	CONTROLS
Natural	116	82
Low forceps	66	113
Midforceps	18	14
High forceps	0	1

These figures should be considered in relation to the duration of the labors. It will be noted that regardless of the fact that more than half of the

trainees had natural deliveries, yet the average duration of their labor was two hours less than that of the controls.

Injuries to the Perineum

The perineum of 24 of the trainees was intact while only 17 of the controls were found uninjured (Table III). Twenty of the trainees sustained lacerations and 24 of the control group. One hundred fifty-six of the trainees had episiotomies and 159 of the controls. It was amazing to note the number of trainees whose lacerations could be repaired in a layer-by-layer method with no local or even intermittent analgesia or respiratory anesthesia, and who even stated that there was no pain at all. When the obstetrician arrived in time for the proper conduct of the second stage of labor and delivery the trainees received perineal infiltration with 2 per cent procaine or perineal block.

TABLE III. INJURIES TO THE PERINEUM

	TRAINEES	CONTROLS
Intact	24	17
Laceration	20	24
Episiotomy	156	159

Types of Anesthesia and Analgesia Used for Delivery

The general anesthesia administered by the personnel of the anesthesia department of our hospital consists of open ether or closed nitrous oxide-oxygen-ether sequence, with a saturation of oxygen at the crowning state.

Eighty-four of the trainees and 198 of the controls had complete general anesthesia (Table IV). Eighty-nine of our trainees received intermittent respiratory analgesia, with or without a local anesthetic, as the only relief for the delivery and repair. The agent used for this purpose was trichlorethylene or rarely a little chloroform. Only two of the controls were delivered with such a small amount of analgesia given by inhalation. We used local infiltration of the perineum 57 times, and perineal block but 4 times. In our experience the local analgesia produced by the perineal infiltration of 2 per cent procaine was adequate for the delivery and repair. Over one-half of our trainees were alert throughout labor and delivery as well as during the repair.

TABLE IV. ANESTHESIA AND ANALGESIA

	TRAINEES	CONTROLS
Complete	84	198
Intermittent	89	2
Local and intermittent	57	
Duodenal block	4	

It is very difficult to explain their reaction to this technique. The joy, the complete satisfaction, the thrilling pleasure, as well as the very evident overpowering sense of accomplishment which these trained patients experience, are impossible to describe. One has to witness a typical case to appreciate

it.   Mere words are powerless to express the psychological reaction that is apparent when these girls first look at their newborn babies and declare their sex.   Those who have gone through it say that they will never forget it. Having witnessed a great many of these deliveries we can appreciate the feelings of the occasional trained patient who has had the experience of a previous delivery without training.   Such a patient has declared that she was cheated out of one of the greatest feelings of pleasure that a woman can experience by not being permitted to feel the birth of her previous baby.

Follow-up Studies

To complete our study, we mailed a return questionnaire postal card to each of the 200 trainees.   These cards were sent to the last known addresses that we had in our files and in a few cases the addresses had been given to us nearly two years previously.   One hundred three of the questionnaires were returned with answers.

Only one of the patients considered that the classes were a waste of time.   Twenty-nine wrote about the abolition of fear, and 20 stated they were more confident of themselves as a result of the training.   There were 18 who emphasized the value of practicing relaxation and 12 others seemed to be most impressed by the shortness of their labors.   Perhaps the fact that only 8 mentioned the value of the exercise was in part due to the fact that over 35 per cent admitted that they did not practice the exercises as directed.   In the remainder of the replies a variety of training benefits were given.   Ninety-five per cent of the trainees stated that they would try the method again.

Summary

In this report 200 primiparous patients who had labor training are compared with 200 primiparous patients who had no training.   The first 100 trainees were consecutive cases appearing at our office for their regular antepartum care.   The second 100 were selected cases, in that most of them had elected to receive the training.   From the study it is evident that labors are shortened by at least 2 hours and that the incidence of delivery by artificial means is lessened by 17 per cent among those trained.   It appears that the training decreases perineal trauma by 5 per cent and there is marked diminution in the use of drugs and anesthesia that tend to asphyxiate the baby as well as produce postpartum hemorrhage.   The psychological benefit to the patient is beyond description.

Comment

In view of our experience with the training of about 400 parous as well as nulliparous patients, we believe that there are certain essentials for the establishment of success with this technique:

1. No patient is properly trained unless she has attended at least four classes of training and has had an opportunity to inspect the labor and delivery rooms under the guidance of an instructor.   It is best to begin training during the first trimester.

2. Greater benefit is obtained by classroom instruction and demonstrations rather than by individual teaching and personal reading of the procedures.

3. We believe that the best results are obtained by training multiparous patients in a separate class from that of the primiparous patients.

4. Labor patients should be out of bed and with their husbands as much as possible during labor and should not be allowed in the same room with other patients who are noisy.

Constant personal attention during the transitional and second stages of labor is a desirable adjunct. Patience, assurance, explanation, and encouragement should be the virtues of the attending nurse. Speed combined with gentleness and dexterity in handling tissues and instruments should be the characteristics of the obstetrician.

We believe that there is a great difference between obstetric surgery and obstetric art.

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BROAD-LIGAMENT PREGNANCY WITH REPORT OF THREE EARLY CASES

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B ROAD-LIGAMENT pregnancy designates that type of extrauterine gestation in which fetal growth and development occur between the anterior and posterior peritoneal folds demarcating that structure. In the literature, it is also designated as intraligamentous or intraligamentary pregnancy, but only rarely as extraperitoneal pregnancy, a most descriptive term employed by Eden and Lockyer[11] for this lesion. Implantation in this locale is secondary and subsequent to the escape of an early embryo through a rent in the mesosalpingeal border of the tube in which nidation initially occurred. Wilson and associates[29] defined as "advanced" those cases of extrauterine pregnancy which continued beyond the fifth month of gestation. "Late cases" were designated by Ware[28] as those reaching beyond the twenty-eighth week. By inference, therefore, cases of broad-ligament pregnancy discovered before the fifth month are early and have so been designated in this report.

As reviewed by Champion and Tessitore,[5] Loschge[16] in 1816 described the first case of broad-ligament pregnancy. In 1860, Tait[27] and Maltakowsky,[21] respectively, reported similar cases. By 1901, Sittner[24] could report 39 cases sorted from 184 abdominal forms. Among 16 cases of abdominal pregnancy recorded by Scipiadis,[23] 5 were in the broad ligament. Rosenblatt[22] in 1923 uncovered 11 other instances among 184 cases of abdominal gestation. In 1938, Champion and Tessitore[5] reviewed all cases of broad-ligament pregnancy recorded in the literature which had reached a period of 7 months' gestation or more and added one of their own. In 13 cases of abdominal pregnancy reported by Ware[28] in 1948, 5 of the cases were of the broad-ligament pregnancy type as could be judged from the findings at operation. Wilson and co-workers[29] in 1948 reported 3 cases of advanced ectopic pregnancy, 2 of which were of the broad-ligament type. Kennedy[15] in 1925 recorded one broad-ligament pregnancy in 613 cases of ectopic gestation and estimated one broad-ligament pregnancy for every 183,900 pregnancies. At the Jewish Hospital of Brooklyn 400 cases of proved tubal gestation were seen between July 1, 1935, and Oct. 1, 1952. Of these, 3 ruptured into the broad ligament, while 2 additional cases were not diagnosed until secondary rupture from their broad-ligament site had occurred (Cases 1 and 2). The exact incidence of broad-ligament pregnancy is, however, difficult to establish, for its rarity predis-

poses to unfamiliarity with its gross characteristics. Many cases, therefore, are erroneously included under the broader designation of abdominal pregnancy.

The anatomy of broad-ligament pregnancy is distinctive and its evolution is as follows: After rupture of the mesosalpingeal border, the early pregnancy is extruded into the broad ligament. As noted in 3 cases of our series, simultaneous intraperitoneal bleeding occurred from the abdominal ostium of the tube. If the amnion remains intact and only the peripheral segment of chorion has been traumatized, the dislodged embryo survives. Further growth and development occur between the leaves of the broad ligament which now forms the supplementary gestation sac. Medially, the expanding ligament ultimately fuses with the uterus, laterally with the bony pelvis, and inferiorly with the levator ani muscles. The shiny congested peritoneal folds of the broad ligament form its outer envelope. The tube lies above, but with expansion of the gestation sac only the medial end is definable. The ovary and the uterovarian ligament are stretched externally across its posterior wall or lie at its summit. When growth direction is more marked anteriorly, the parietal peritoneum is raised from the anterior abdominal wall so that the uterovesical reflection may reach the level of the umbilicus. This comprises the anterior extraperitoneal pregnancy type as described by Eden and Lockyer.[11]

When expansion of the enlarging fetal sac is more marked posteriorly, the posterior leaf of the broad ligament, the posterior parietal and cul-de-sac peritoneum are elevated and ultimately reach into the mesocecum or mesosigmoid. The bowel lies in front of the gestation sac as noted in Deming's[9] case. This represents the posterior form of extraperitoneal pregnancy recounted by Eden and Lockyer.[11] It is to be emphasized that in both types the fetus lies below the placenta and the round ligament courses in front of the gestation sac.

If the accidents of rupture and/or hemorrhage do not occur, the broad-ligament pregnancy proceeds to term when pseudolabor appears. Fetal death soon follows and failure of delivery is the rule. In absence of infection, the amniotic fluid is gradually resorbed and the sac slowly shrinks. The placenta is reduced in size and becomes cornified, or following liquefaction may be ultimately resorbed. The fetus undergoes mummification or calcification. Menstruation returns after a varying interval, the patient often remaining symptom free. Ware reports three patients seen 6, 9, and 26 years, respectively, after unrecognized abdominal and/or broad-ligament pregnancy who had in the interim delivered children.

The clinical aspects of broad-ligament pregnancy are not unlike those in other forms of extrauterine pregnancy. Negro patients predominate and all of Ware's[28] patients were of the Negro race. MacGregor's,[20] 11 cases of abdominal pregnancy showed a predilection for primiparas or early multiparas and his report emphasized the history of prolonged infertility. Since broad-ligament pregnancy follows tubal nidation, the initial symptoms are those of tubal pregnancy. Delay in menses, irregular spotting, and pain in

the lower abdomen have usually been erroneously ascribed to a threatened abortion. As the pregnancy advances, continued soreness in the abdomen and painful fetal movements are dominant. Intestinal compression and adhesions to the sac are probably causative of indigestion and weight loss. Dysuria should be especially common in the anterior broad-ligament pregnancy due to displacement of the bladder and stretching of its vesicoperitoneal fold. Vaginal bleeding may be a disturbing complaint. In Case 2 of Ware's series it was "considerable during the fifth, sixth, and seventh months." At term, pseudolabor is manifested by crampy abdominal pains in association with spotting or staining. After a varying period they spontaneously subside and fetal movements soon cease. Following fetal death, a low-grade temperature and anorexia may be noted but many patients are free from complaints.

The physical findings of broad-ligament pregnancy vary with its duration. Early in its course, the findings are those of tubal gestation and a tender mass is present lateral to the uterus. In our Case 1, however, its presence close to the abdominal wall caused its erroneous designation as an ovarian dermoid. Movement of the cervix causes pain because of pull on the expanded parametrium. Even a cul-de-sac hematoma is mimicked by the posterior broad-ligament type, in which the fetal sac elevates and occupies the cul-de-sac area. When the broad-ligament pregnancy attains abdominal position, the uterus lies to the opposite side and is displaced upward. By comparison with the expanded broad ligament, it is firm but it is usually concealed by the softer, tense, smooth and contiguous gestation sac. Braxton Hicks contractions cannot be felt. In both anterior and posterior types of broad-ligament pregnancy the "supposed uterus" does not move freely. The lower portion occupies a lateral rather than central position and is seemingly incorporated with Poupart's ligament and the lateral pelvic wall. These findings are predicated upon anatomical considerations. Actually, detailed recording of physical and operative findings in broad-ligament pregnancy are too meager to confirm or negate this conclusion. Fetal parts are easily discerned in the anterior broad-ligament lie, and the fetal heart is loudest below the umbilicus. With posterior broad-ligament pregnancy, fetal palpation is less distinct because of overlying bowel and omentum. Here the percussion note is accordingly tympanitic contrasting decidedly with the flat note over a normal pregnant uterus or an anterior broad-ligament pregnancy lie. Abnormal fetal position is the rule in all forms of extrauterine pregnancy.

Scipiadis[23] emphasized that a correct diagnosis of broad-ligament pregnancy can be made at term by (1) palpation of a tumor mass in the pelvis independent from the uterus, (2) finding of a tense band (the round ligament) originating from the margin of the displaced uterus and coursing across the anterior face of the smooth and circumscribed tumor. This is in contrast with pregnancy in a rudimentary horn where the round ligament is fetal lateral to the tumefaction. Beacham and Beacham[2] note that in intra-abdominal pregnancy the round ligaments cannot be felt. Recognition of the round ligament over the anterior face of the abdominal mass is of importance, therefore, in establishing the presence of a broad-ligament pregnancy. Whether it

can be clinically defined in all cases, and when in the individual case it first becomes manifest, cannot be stated. During pseudolabor abdominal palpation fails to reveal the presence of contractions and, if discovered, these are restricted to the small zone occupied by the displaced uterus. After fetal death, the abdominal mass recedes in size and the uterus may then be separately recognized by its classical contour and firm consistency, though it still fuses with the expanded broad ligament. Fetal parts are recognized but fetal movement is lacking.

The vaginal findings in broad-ligament pregnancy are important. In all stages the cervix is only slightly softened. In advanced and late cases it is displaced either to the opposite side or upward behind the symphysis. It is dubious, however, whether this is absolutely diagnostic of broad-ligament pregnancy, for, in abdominal pregnancy, Ware notes displacement of the cervix if the low-lying placenta occupies the cul-de-sac. However, in broad-ligament pregnancy anatomical distortion should cause depression or even obliteration of the vaginal fornix on the side of the pregnancy. The lower pole of the gestation sac is expected to fuse with and be incorporated into the cervix and may extend caudad to it. During pseudolabor, in spite of the prolonged duration of pains, the cervix shows slight if any dilation of the external os, and effacement is lacking.

Rupture of the gestation sac, hemorrhage, or both interrupt the course of the broad-ligament pregnancy, for dangerous clinical manifestations make operation mandatory. Its frequency and time of occurrence cannot be stated without review of each case recorded. In Ware's series of late extrauterine pregnancies there were 5 cases of broad ligament pregnancy. These ranged from 28 to 60 weeks in duration without manifestations of internal bleeding or rupture of the sac. In 2 of our 3 cases of early broad-ligament pregnancy rupture and bleeding necessitated surgical intervention. In Case II of Wilson's[29] series, operation was performed in the thirty-sixth week of a broad-ligament pregnancy. Although no blood was found in the peritoneal cavity, the patient was in shock. In Deming's[9] case, rupture and internal hemorrhage occurred one year after the onset of symptoms. If operation is performed early, the fetus may still be confined to the broad ligament and only the rent is visible (Cases 1 and 2 of this series). Later, the fetus and amniotic sac are free in the abdomen. The possibility of an ultimate abdominal pregnancy resulting from an antecedent broad-ligament pregnancy position exists early in pregnancy. The advent of hemorrhage and/or rupture is indicated by the abrupt onset of severe pain and is associated with the usual manifestations of shock and internal bleeding. The fetal heartbeat cannot be heard. Because of muscle spasm, palpation of the gestation sac, uterus, or fetal parts is most difficult. The flanks are dull to percussion and shifting dullness is present if internal hemorrhage is marked.

Late infection of the gestation sac may occur and resulting suppuration causes communicating fistulas with rectum or bladder or both. Eastman, commenting on a case report, "Discharge of Fetal Bones by Rectum," notes that

because of proximity to the rectum this outcome is particularly frequent in broad-ligament pregnancy.

The diagnosis of abdominal pregnancy is occasionally made before surgical intervention; that of broad-ligament pregnancy practically never. Initially the history and findings are those of tubal gestation and differentiation cannot be made. For, if the expanding broad ligament bulges toward the cul-de-sac it mimics ectopic pregnancy with pelvic hematocele, while anterior expansion of the soft circumscribed broad ligament simulates ovarian tumor. Later in the course of broad-ligament pregnancy, the slightly enlarged and displaced uterus fuses imperceptibly with the distinct soft mass lateral to it. Ultimately, fixation of the lower pole of the "supposed uterus" and its fusion with Poupart's ligament and the lateral pelvic wall afford distinctive criteria for the differentiation of broad-ligament pregnancy from intra-abdominal pregnancy. In the anterior broad-ligament type, too, the sharply delineated mass contrasts with the irregular and poorly defined outlines of abdominal pregnancy. The percussion note in the anterior form of broad-ligament pregnancy is dull, similar to that of normal pregnancy. A tympanitic note is obtained in true abdominal pregnancy as also in the posterior type of broad-ligament pregnancy. The recognition of the round ligament across the anterior face of the gestation sac has already been emphasized as a diagnostic aid in advanced and late cases of broad-ligament gestation. Giant ovarian tumors or large fibroids associated with intrauterine gestation may offer difficulty. In both these lesions, however, the cervix is soft and Braxton Hicks contractions can be detected.

If the patient is first seen during pseudolabor, failure of dilatation and retraction of cervix, depression or obliteration of a vaginal fornix, abnormal lie of the fetus, and absence of palpable uterine contractions indicate the broad-ligament pregnancy type of extrautreine pregnancy. The failure of delivery after cessation of pain and the advent of fetal death are classical terminal events. Intrauterine pregnancy after pseudolabor can be established by the central location of the pregnant uterus and its relatively sharp definition, typical contour, and softened cervix. If a patient with broad-ligament pregnancy is seen during an episode of internal bleeding or rupture, tenderness and spasm of the abdominal wall preclude accurate findings. In early stages of gestation, rupture of an interstitial pregnancy or of a gravid rudimentary horn of a bicornuate uterus are possibilities. Later, spontaneous uterine rupture or intraperitoneal bleeding from a uterine or broad-ligament varix can be excluded only by operation. Cases with infection pose even more difficulties.

Hoffman,[13] in discussion of Ware's report, emphasizes the importance of repeated x-ray plates in diagnosis. In all forms of extrauterine gestation, there is persistence of fetal site and position. This contrasts with shifting small parts and alteration of position noted in uterine pregnancy. From the anatomical aspect, x-ray in broad-ligament pregnancy should reveal the fetus relatively low in the abdomen, in abnormal position with the spine overflexed, whereas in abdominal pregnancy the fetus should assume a higher position

in the abdominal cavity. Only accumulated observations can verify this assumption. MacGregor,[20] reviewing the x-ray findings in intra-abdominal pregnancy, notes the presence of demonstrable gas bubbles in front of the head as diagnostic of intra-abdominal lie of the fetus. But the posterior type of broad-ligament pregnancy with bowel anterior to the sac can reveal similar findings. The recognition of the uterus as distinct from the pregnancy may be established by hysterogram. In missed labor with a dead fetus, x-ray will reveal the fetal skeleton confined within the uterine cavity if the technique for soft tissue mass is instituted.

Other methods have also been employed to identify the uterus as distinct from the abdominal tumefaction. Colvin and McCord[6] injected large doses of Pituitrin, the resulting palpable contractions allowing differentiation of this organ. Cross and associates[8] found this technique useful in their series of 19 cases.

The prognosis in broad-ligament pregnancy is serious. Champion and Tessitore,[5] reviewing 70 cases beyond the seventh month, reported a maternal mortality of 16 per cent. Ware,[28] in 240 cases of extrauterine pregnancy of all types beyond the seventh month, found a maternal mortality of 14.85 per cent. Among the 251 babies of his series (2 sets of twins) only 60 were born alive, 40 were stillborn, and 50 died in the early postnatal period. The fetal mortality was 75.6 per cent. Suter and Wichser[25] record that of 41 living viable babies in extrauterine pregnancies reported in the literature, 38.7 per cent were born deformed and 24.3 per cent died before the eighth postpartum day. Of the deformed babies, 75 per cent showed malformation of the head. In 5 cases of broad-ligament pregnancy in Ware's series, only one fetus was alive and normal. Baden and Heins,[1] reviewing 90 cases of ovarian pregnancy, encountered 11 cases of viable gestations. Seven infants (63.3 per cent) were stillborn, and 4 (36.4 per cent) were alive at birth. Two of the 11 viable babies were grossly malformed. Whether similar figures obtained in broad-ligament pregnancy remains to be established.

Except as noted below a diagnosis of broad-ligament pregnancy requires early operative intervention. Even with the fetus close to viability, the high incidence of malformation and early neonatal death apparently warrants this course. In its initial phase, when tubal rupture has allowed the expulsion of the fetal sac into the broad ligament, surgery requires removal of the tube, evacuation of the products of gestation from the broad ligament, complete hemostasis, and adequate blood replacement. In early, advanced, and late cases of broad-ligament pregnancy it should be remembered that the placenta lies high in this expanded structure and, to avoid its separation, incision through either leaf should be made as low as possible. After evacuation of the fetus, the cord is tied close to the amnion and the placenta is left in situ. This is followed by closure of the broad ligament. Oozing may require a temporary pack which can be led externally through an adjacent stab-wound. Continued bleeding, however, means partial placental separation and indicates its immediate removal. If bleeding nevertheless persists, hysterectomy may be compelled to secure hemostasis, as in Case 2 of this series and in several of the

patients treated by Ware. Marsupialization of the broad-ligament sac after removal of the placenta, as was performed in Case 1, is not a recommended procedure. Patients with the placenta left in situ in all forms of extrauterine pregnancy require close postoperative observation. Luria[18] reports secondary operation for bleeding from the site of the retained placenta. Suppuration of the placenta is recorded, respectively, by Ware[28] and Deming.[9] Liquefaction and resorption of the placenta take a long time. In Branscomb's[4] series, Case 2 showed an abdominal mass corresponding to the size of a 6 months' gestation, when she was examined 8 months after operation. MacGregor[20] describes the placenta the size of an orange 16 months after surgery, and Studdiford[26] notes a persistent mass 13 months after laparotomy. In Jewett's[14] case, operated upon at the Long Island College Hospital, appendectomy 2½ years later revealed complete absorption of the placenta left in situ in a previous abdominal pregnancy. If fetal death has occurred, it is best to defer surgery until the Aschheim-Zondek or Friedman test becomes negative, affording proof of the occlusion of the placental sinuses. Removal of the fetus, sac, and placenta in toto may then be more safely performed. All surgical procedures require the presence and use of adequate amounts of blood for transfusion.

Case Reports

The history of three cases of early broad-ligament pregnancy are abstracted below. Cases 1 and 2 are from our gynecological service of the Jewish Hospital of Brooklyn and Case 3 from the private service of the late Dr. J. O. Polak and Dr. M. P. Armstrong of the Long Island College Hospital.

CASE 1.—Mrs. R. V., aged 34 years, a Negro, was admitted to the Jewish Hospital of Brooklyn, June 3, 1948, complaining of abnormal bleeding and severe pain in the lower left quadrant. The last normal menses had occurred April 14. The May period was delayed but slight vaginal spotting was noted on May 28, and it was associated with pain in the left lower abdomen described as severe and knifelike. Dizziness and vomiting were also present. Spotting and pain persisted until admission but the pain was of reduced severity. Appendectomy and right ovarian cystectomy had been performed in 1942. The menses began at 13 years and recurred regularly every 28 days, lasting 4 to 5 days. The patient was married eight years. Two miscarriages, both at 3 months, had occurred spontaneously in 1946 and 1947, respectively.

Examination upon admission revealed temperature 98.6° F., pulse 80, respirations 20, blood pressure 120/80. The general physical examination was essentially negative. The abdomen though soft was slightly distended with tenderness in the left lower quadrant. Pelvic examination revealed a normal introitus. The cervix pointed in the vaginal axis and was slightly softened but closed. The uterine body was retroverted and slightly enlarged and softened. The right fornix was normal. A cystic tender mass 5 by 3 cm. was located in the left fornix, anterior to the uterus, and was interpreted as an ovarian cyst associated with early pregnancy. The urine examination was normal. The blood count revealed hemoglobin 65 per cent, red blood count 3.3 million, white blood count 9,700, neutrophils 67 per cent, band forms 2 per cent, lymphocytes 27 per cent, monocytes 3 per cent, and eosinophils 2 per cent. The sedimentation rate was 13 mm. in one hour. The Friedman test performed June 4 was reported as positive. The patient was discharged to the obstetrical department. When seen there on June 17, she was symptom free. The uterine size coincided with the duration of pregnancy. The "left ovarian mass" was now insensitive and questionably larger but not clearly defined from the uterus. By July 28, a separate left-sided mass could not be identi-

fied. The supposedly enlarged uterus was noted as asymmetrical and possibly containing a soft fibroid. On July 31, after coitus, the patient was seized with severe stabbing pains about the umbilicus and fainted. Upon readmission to the hospital the blood pressure was 90/60 and the pulse 126. The temperature was 97.8° F. The abdomen was tense, tender, with rebound tenderness throughout. The flanks were flat to percussion. Vaginal examination was noninformative. The incomplete preoperative diagnosis was intra-abdominal hemorrhage with pregnancy.

After a transfusion of 1,000 c.c. of blood, laparotomy was performed through a lower midline incision. The abdominal cavity contained about 2,000 c.c. of fluid and clotted blood. A blue-domed mass about 15 to 20 cm. in diameter originated in the left side of the pelvis and extended upward. It fused medially with the slightly enlarged and displaced uterus, and laterally and superiorly with the sigmoid and several loops of small bowel. The left tube and ovary could not be defined but the left round ligament was distinct and crossed the anterior face of the blue-colored cyst. On its posterior aspect the latter presented a rent about 4 cm. in length from which active bleeding was proceeding. The right adnexa were negative. During examination the posterior rent was by accident further developed and an intact amniotic sac with its contained fetus was exposed. The membranes were accordingly ruptured and the 3 to 4 months' fetus was delivered. The cord was clamped close to the placenta which lay above the fetus and undisturbed. Active bleeding, however, continued from the broad ligament. The widely separated leaves were accordingly marsupialized and the cavity tightly packed. Closure of the abdomen was performed in layers. An additional 1,500 c.c. of blood was administered during the operation, but upon its completion the condition of the patient was poor with the blood pressure 60/30 and the pulse 120. An additional transfusion of 2,500 c.c. of blood was given slowly but the blood pressure remained at 86/60 and the pulse rate at 140. At the end of 24 hours the temperature was 101° F., pulse 110, and the urine output reduced to 610 c.c. Oliguria persisted and azotemia appeared by the third day. The kidney output was adequate, however, by the eighth day when bronchopneumonia became evident. The patient died from this complication on the tenth day after operation. A postmortem examination could not be obtained.

CASE 2.—Mrs. M. J., Negro, aged 30 years, was admitted to the Jewish Hospital of Brooklyn on Jan. 3, 1949, complaining of chills and fever, and abdominal cramps of 3 months' duration. The family and past personal history was irrelevant. Menses began at the age of 12, recurring every 27 to 30 days, lasting for 4 to 5 days. The patient, a para iv-0-0-iv, had been married for 10 years and all confinements were without incident.

The last normal period occurred Oct. 4, 1948. In the interval between the termination of her menses and admission, the patient had a profuse intermittent green discharge. There was no bleeding at any time. However, she experienced four episodes of abdominal cramps associated with chills, fever, nausea, and vomiting, each episode lasting for 3 to 5 days.

Upon admission the temperature was 99° F., pulse 92, and respirations 20. The head, neck, and thorax were essentially normal. The abdomen revealed a mass in the hypogastrium reaching from the pelvis to a point about 2 fingerbreadths below the umbilicus. It was irregular in contour, nodular on the right, but elsewhere smooth, soft, and compressible. The pelvic, findings revealed normal parous soft parts. The cervix was posterior and soft. The uterus, as outlined above, was estimated the size of a 4 to 4½ months' pregnancy. Because of its nodularity and excessive size as judged from the duration of amenorrhea a diagnosis of pregnancy with degeneration in a concomitant fibromyoma was made. The urine examination was normal. The blood count revealed hemoglobin 77 per cent, red blood count 4.1 million, white blood count 6,000, neutrophils 61 per cent, band forms 2 per cent, lymphocytes 34 per cent, and monocytes 3 per cent. The sedimentation rate was 20 mm. The Friedman test was positive. The blood chemistry was normal. On the afternoon of January 4, the patient was abruptly seized with severe pain in the lower abdomen which was similar to that experienced during the attacks prior to her admission. The temperature was 100.2° F., the pulse 100, and respirations 26. The abdomen was now slightly distended and tenderness and rebound were noted in the left lower quadrant. The uterus, too, was markedly sensitive. By

9:30 A.M. on January 5, the patient showed pallor and air hunger. The blood pressure was 72/50 and the pulse 160. The hemoglobin now was 9.8 Gm. and the hematocrit 27. Abdominal distention had further increased but the flanks were tympanitic. Vaginal examination revealed a bulging cul-de-sac. A diagnosis of ruptured interstitial pregnancy was now entertained. After a transfusion of 1,000 c.c., laparotomy was performed under cyclopropane anesthesia. The abdominal cavity contained about 2,000 c.c. of free and clotted blood. The left broad ligament was expanded, presenting a sacular mass measuring 20 by 15 cm., smooth, shiny, and purple in color. This ruptured during examination and a fetus the size of a 4 months' pregnancy and its surrounding amnion escaped into the abdominal cavity, revealing the bed of the pregnancy. Its medial border was formed by the uterus which was only slightly enlarged and firm. Superiorly and laterally the broad ligament fused with small and large bowel. The placenta lay in the superior aspect of the expanded broad ligament and the round ligament showed no special changes. The right adnexa were negative. The left tube and ovary could not be identified. Partial separation of the placenta and free bleeding made its removal mandatory and the continued oozing from the left lateral wall of the uterus necessitated supracervical hysterectomy. The ragged edges of the broad ligament were excised and then reapproximated. An additional 2,500 c.c. of blood was administered during the operation. Closure was in the usual manner. The postoperative course was uneventful and the patient was discharged on the twelfth postoperative day.
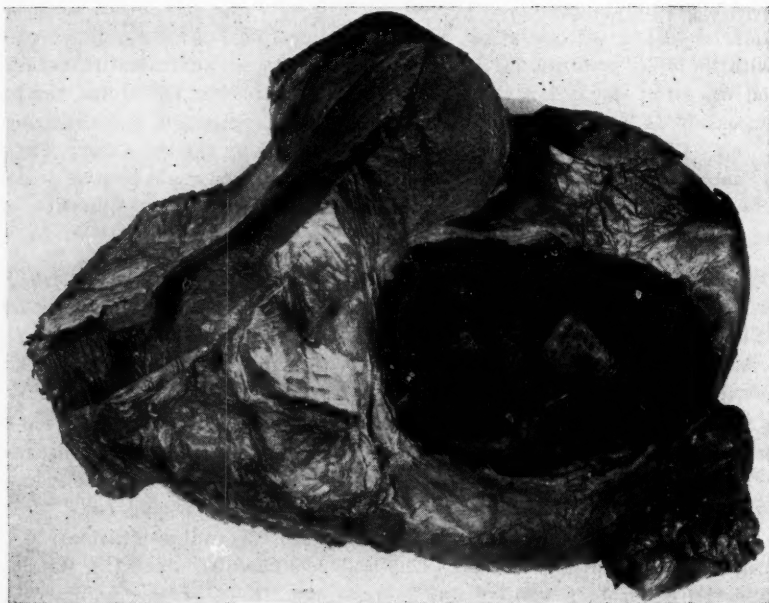

Fig. 1 (Case 3).—Autopsy specimen obtained 5 days after operation. The expanded broad ligament has been opened on its anterior aspect revealing the placenta in the posterosuperior position. The gestation sac fuses with the lateral aspect of cervix and uterine body, and its lower pole lies caudad to the cervix. Laterally it fuses with the mesosigmoid. Note the smooth contour and ovoid configuration of the expanded broad ligament.

The pathological specimen consisted of a supracervically amputated uterus, fetus, membranes, and placenta. The uterus measured 7 by 8 by 5 cm. The left horn was jagged and irregular. A subserous fibroid nodule 5 by 1.5 mm. presented in the right superior wall. The uterine cavity presented a furrowed, pink-brown lining. The myometrium measured 2.5 mm. in thickness. The fragmented placenta measured 9 by 6 by 0.5 cm. and was brown red in color. The normally formed female fetus measured 18 cm. in length.

CASE 3.—Mrs. E. W., aged 37 years, white, was admitted to the Long Island College Hospital on April 8, 1931, complaining of abdominal pain of 2 weeks' duration, nausea and

vomiting of 5 months' duration, and blood-tinged vaginal discharge for one month. The family and past personal history was irrelevant. Menses began at 14, recurred regularly every 28 days and lasted for 3 days. The patient had been married for 15 years. The only pregnancy 11 years ago was terminated by criminal abortion at 8 weeks.

The last period occurred Oct. 5, 1930. Three attempted criminal abortions, Nov. 17, 1930, Feb. 9 and March 14, 1931, were unsuccessful, though bleeding followed each attempt. Abdominal enlargement and soreness in the left lower abdomen were the dominant complaints. The physical findings were irrelevant, except for the presence of a tumor mass filling the left side of the pelvis, and displacing the normal-sized uterus to the right and upward. The urine examination was normal. The blood examination showed mild secondary anemia. A diagnosis of broad-ligament pregnancy was made by Dr. J. O. Polak. Operation on April 9 revealed the left broad ligament enlarged and distended by a bloody cystic mass. The round ligament was not especially prominent. Incision through the anterior fold revealed an amniotic sac with a fetus of a 4 to 5 months' gestation enclosed in its membranes. After rupture, this was delivered by breech extraction. Only moderate bleeding followed and the placenta was accordingly left in situ (Fig. 1). Death followed 5 days later from fulminating peritonitis which was confirmed by autopsy. The uterus and adnexa showed microscopic evidence of diffuse infection of the uterus and tubes as the likely source of the fatal ascending peritonitis.

Summary and Conclusions

1. Broad-ligament pregnancy is a rare form of extrauterine gestation. It follows primary tubal nidation. After rupture of the mesosalpingeal border of the tube, survival of the escaped embryo depends upon an intact amnion and a preserved choriothrophoblast. The broad ligament then becomes the secondary gestation sac.

2. The anatomy of broad-ligament pregnancy is distinctive, allowing differentiation from other types of extrauterine gestation. The high location of the placenta above the fetus is stressed. The purple shiny envelope of expanded broad ligament contrasts with the gray-white sac encountered in abdominal pregnancy.

3. Clinically, the initial phase of rupture is similar to that of all types of tubal gestation. In its early, advanced, and late phases, broad-ligament pregnancy shares the complaints of other forms of extrauterine pregnancy.

4. Largely predicated on anatomical considerations, the following physical findings are diagnostic of broad-ligament pregnancy: (a) upward and lateral displacement of the uterus by a soft, sharply defined mass lateral to and incorporated with the body of the uterus and cervix (early stage); (b) relative fixation of the gestation sac ("supposed uterus") upon lateral movement of the patient (late stage); (c) fusion of the gestation sac with Poupart's ligament and the lateral pelvic wall (advanced and late stages); (d) incorporation of the cervix into the medial border and lower pole of the abdominal mass (all stages); (e) depression or obliteration of the vaginal fornix on the side of pregnancy (advanced and late stages); (f) palpation of the round ligament across the anterior aspect of the pregnancy, which is distinctive in the late stage.

5. Repeated x-ray studies are of great importance in establishing the diagnosis of all forms of extrauterine pregnancy. Hysterogram allows positive

identification of the uterus as separate from the pregnancy. A low fetal lie and fixed fetal position on repeated x-ray suggest a broad-ligament pregnancy site.

6. Advent of internal hemorrhage or rupture or both in broad-ligament pregnancy produces the picture of an acute abdominal crisis in association with pregnancy. At this stage accurate diagnosis is most difficult. Two cases of early broad-ligament pregnancy with rupture and intra-abdominal bleeding are herein recorded.

7. The maternal prognosis in broad-ligament pregnancy is serious. Rupture and/or abdominal hemorrhage are grave complications. After pseudolabor and fetal death, the prognosis is improved with cessation of placental circulation.

8. Because of restriction in position and an impaired placental circulation, the fetal mortality is high even if viability has been reached. This is predicated on the high incidence of malformation and neonatal death recorded for other forms of extrauterine gestation.

9. Treatment of broad-ligament pregnancy is surgical. Incision into the broad ligament to evacuate the fetus should be as low as possible to avoid separation of the placenta which lies at the summit of the structure. After removal of the fetus and ligation of the cord, the placenta is retained in situ. Continued bleeding, however, requires hysterectomy for adequate hemostasis. After pseudolabor and fetal death, surgical intervention should be deferred until chorionic gonadotrophin is absent in the urine. The thrombosed placenta, fetus, and sac may then be more safely removed. Transfusion is an absolute requisite in all cases.

10. All cases of extrauterine pregnancy require more detailed recording of symptoms and physical findings. A careful description of the anatomy encountered at operation will allow more selective division of extrauterine pregnancy into its several anatomical types. The position of the placenta and the course of the round ligament should be especially noted.

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9 PROSPECT PARK WEST
499 OCEAN AVENUE

THE USE OF INTRAVENOUS SACCHARATED OXIDE OF IRON IN OBSTETRICS AND GYNECOLOGY

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THE problem of anemia in the obstetrical and gynecological patient seen in the city hospitals has always been a formidable one. Many patients entering our hospitals for gynecological procedures or for delivery show an extremely low hemoglobin level. In gynecological patients, we can often delay treatment to allow us to raise the hematologic status to a safe level. However, in maternity patients, the amount of time necessary to accomplish this is often not allowed us, since many of them are first seen late in the third trimester, when anemia is most severe, and a rapid method of improving the patient's anemia is of utmost importance. The deleterious effects of anemia in the third trimester of pregnancy have been shown time and time again. Holly[1] suggests that a latent iron deficiency exists in nearly every pregnancy in the last trimester. Many authors, such as Rath,[8] have shown that patients coming to delivery with anemia often have prolonged labors; and McLean[9] believes that infants born of anemic mothers are often deficient in the stores of iron. Thus, it can be seen that from many aspects it is of utmost importance to alleviate this anemia.

The results of oral medication, at best, are inconsistent and a prolonged period of time is often required for a good response. Kartchner and Holmstrom[4] suggest that achlorhydria many times accompanies pregnancy and interferes with oral iron therapy. They also claim that only 3.1 per cent of oral iron is absorbed in the intestinal tract, and approximately six weeks are required for maximum hemoglobin response. We, however, do not claim that the intravenous method of administration of iron should take the place of oral medication if time allows and intestinal absorption has proved to be good. Our chief interest has been in those cases where the time element is short and rapid results are desirable.

Dosage, Method of Administration, and Clinical Material

The saccharated oxide of iron used in this study* is prepared in 5 c.c. ampules, each cubic centimeter containing the equivalent of 20 mg. of elemental iron. The patients all received five injections of 5 c.c. each on alternating days, giving them a total of 500 mg. of iron for the complete treatment. A 1½ inch, 22 gauge needle on a 20 c.c. syringe was used as standard equipment. Since the intravenous iron preparation is almost black in color, it was diluted with 10 c.c. of normal saline or distilled water to facilitate the withdrawing of

blood to ascertain the presence of the needle in the vein. The needle of small bore was used to prevent too rapid an injection. The rate of injection was found to be of utmost importance. At least three minutes were used for each injection. Except for 10 patients used at the beginning of the study, all injections were given on an outpatient status.

Prior to the beginning of the treatments, venous blood was drawn from the antecubital vein and the hematocrit, red blood count, grams hemoglobin, mean corpuscular volume, mean corpuscular hemoglobin, and the mean corpuscular hemoglobin concentration were determined. These tests were repeated immediately following the completion of the treatments and two weeks later. In the case of antepartum patients, blood was again drawn prior to and following delivery. One technician was utilized to perform all the tests for this study to reduce the human error.

In all, 89 patients were treated with intravenous saccharated iron; however, because of the difficulty in follow-up a total of 67 patients were utilized for this study. The following is a summation of the types of cases used:

Postpartum patients	13
Antepartum patients	32
Gynecological patients	18
Well patients	4

Because many of our clinic patients are delivered at other hospitals, only 17 of the antepartum patients were followed through to delivery. The gynecological patients presented anemias mostly due to blood loss following abortions or extensive operative procedures. The postpartum patients were those delivered at this hospital with no prenatal care or prenatal care by other agencies and with anemia made known to us only following delivery.

Reactions

At the onset of this study, a test dose of 2 c.c. of saccharated oxide of iron was given to determine toxicity. However, this practice was soon eliminated since we feel that the reactions experienced by the patients were due to rapid administration and not to the medication per se.

In all, 440 injections were given during the course of this study. Reactions were noted following 24 injections, or in 5.45 per cent of the cases. It is interesting to note that almost all the reactions were noted during the early part of this study. With slow and careful administration, no ill effects were seen. The following is a summation of the reactions:

Syncope	5
Lumbar pain	5
Flushing and dyspnea	4
Choking sensations	3
Headache	3
Nausea and vomiting	2
Pain at the site of injection	2
	24

Extravasation at the site of injection appeared to be the most serious and prolonged of the reactions. The other ill effects were transitory, never lasting more than five minutes and occurring within two to three minutes following rapid injection.

Results

After using intravenous saccharated oxide of iron in 67 patients, we feel that this preparation has a very definite place in the armamentarium of the obstetrician and gynecologist. In this series of cases, the average increase in the hemoglobin level was 2 Gm. within two weeks of receiving treatments. This indicates that with intravenous saccharated iron one can expect to raise a patient's hemoglobin level within three weeks, allowing one week for treatment and two weeks for reaction. Since all the patients do not respond uniformly to this medication, we have attempted to show the general trend by the use of superimposed graphs.
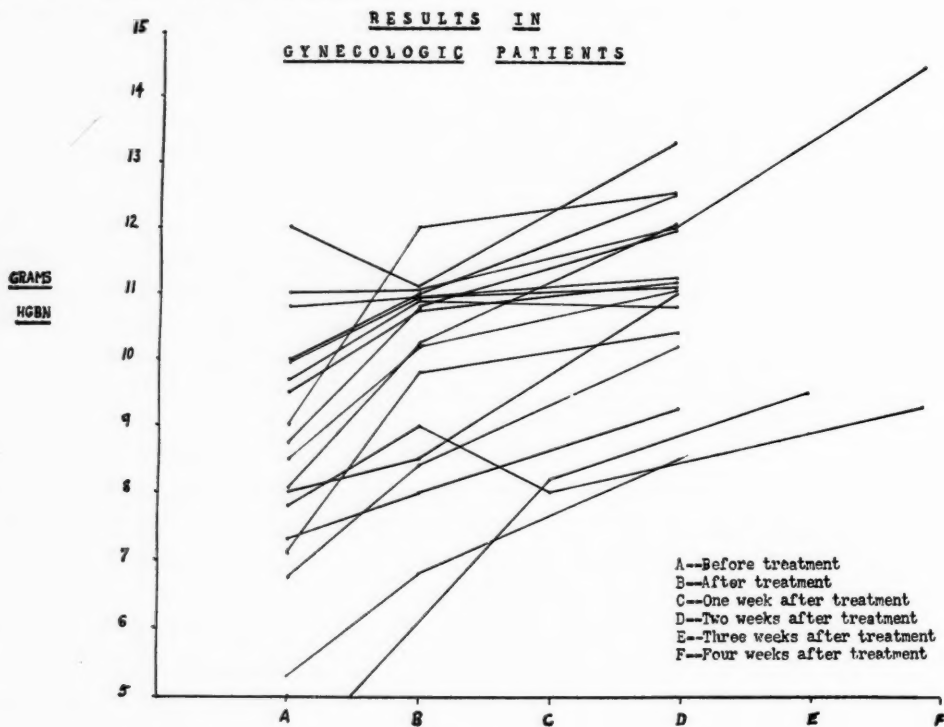
Fig. 1.

In Fig. 1 the reaction of the gynecological patient is shown. The average increase in hemoglobin level was 2.5 Gm. The range in the elevation of hemoglobin in the favorable cases was from 1.1 Gm. to 5.46 Gm. One patient showed no hematological response. The reaction in these cases can definitely be considered favorable. It can be noted that the greatest rise in hemoglobin level was found in those patients who were particularly anemic at the onset of treatment. This fact, as will be seen in the other graphs, holds true in all cases.

RESULTS IN
POSTPARTUM PATIENTS

GRAMS
HGBN

A—Before Treatment
B—After treatment
C—One week after treatment
D—Two weeks after treatment
E—Three weeks after treatment
F—Four weeks after treatment

Fig. 2.

RESULTS IN
ANTEPARTUM PATIENTS
(No delivery data)

GRAMS
HGBN

First trimester ....
Second trimester — — — —
Third trimester —————

A—Before treatment
B—After treatment
C—One week after treatment
D—Two weeks after treatment
E—Three weeks after treatment
F—Four weeks after treatment
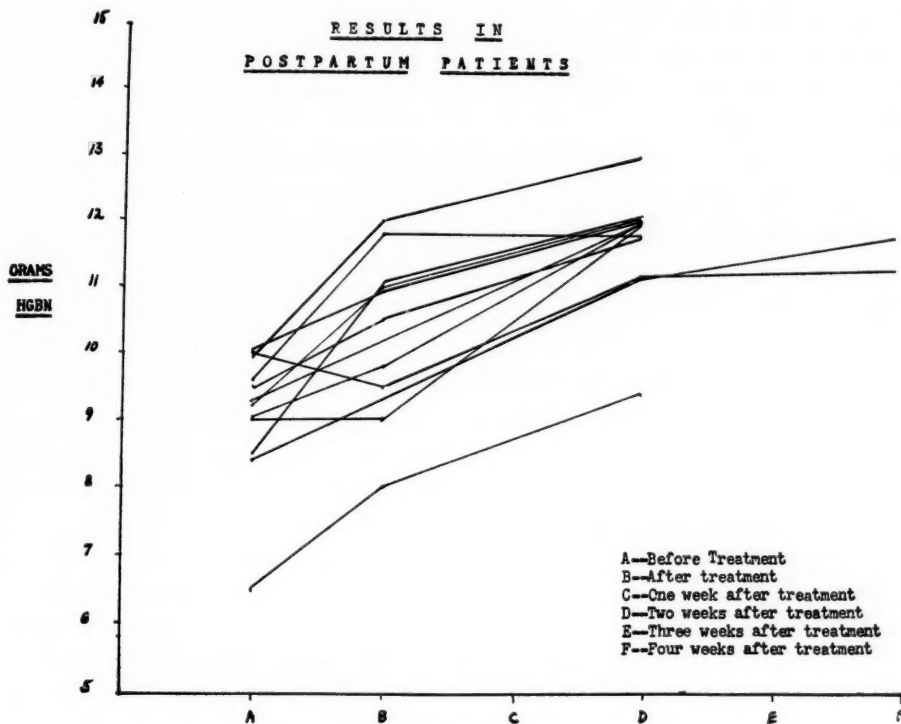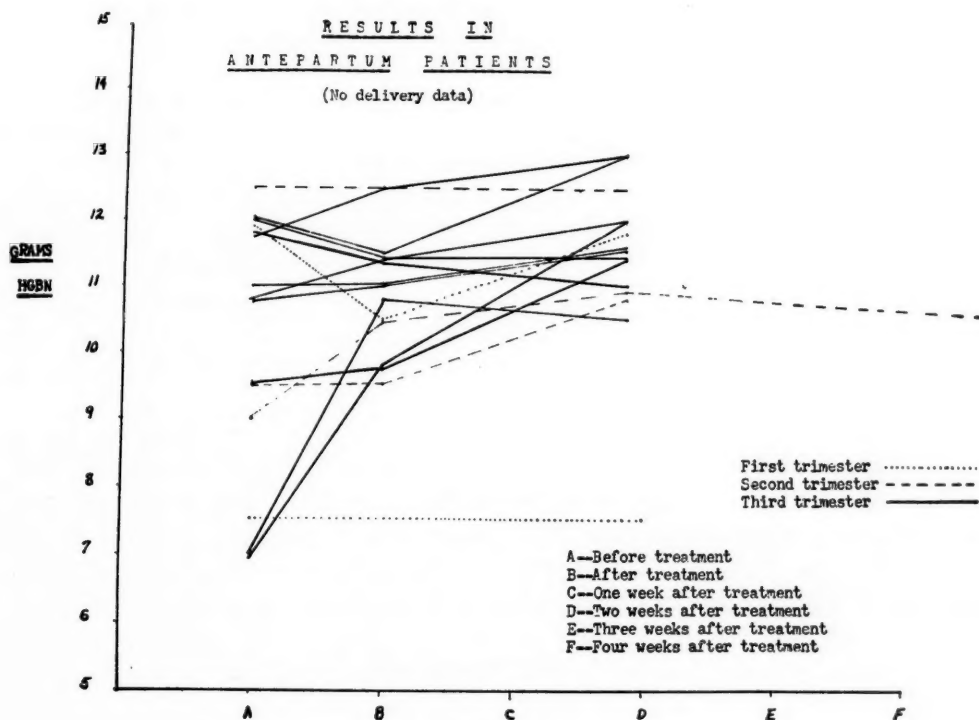
Fig. 3.

The reactions of postpartum patients are summarized in Fig. 2. Here the average increase in hemoglobin was 2.27 Gm., and the range in elevation in the favorable cases was from 1 Gm. to 5.5 Gm. One patient showed no hematological response at all.

In Fig. 3 we have summarized the reactions of antepartum patients for whom no delivery data was available. The average increase in hemoglobin in these cases was 1.04 Gm. Five patients in this group showed no hematological response to the intravenous saccharated iron. The range of the hemoglobin rise in those cases showing a favorable reaction was from 1 Gm. to 5 Gm. Our best responses in this group occurred in those patients who were closest to their estimated date of confinement and also in those with the lowest hemoglobin level at the onset of treatment.

RESULTS IN ANTEPARTUM PATIENTS
(With delivery data)

A—Before treatment
B—After treatment
C—Two weeks after treatment
D—Delivery
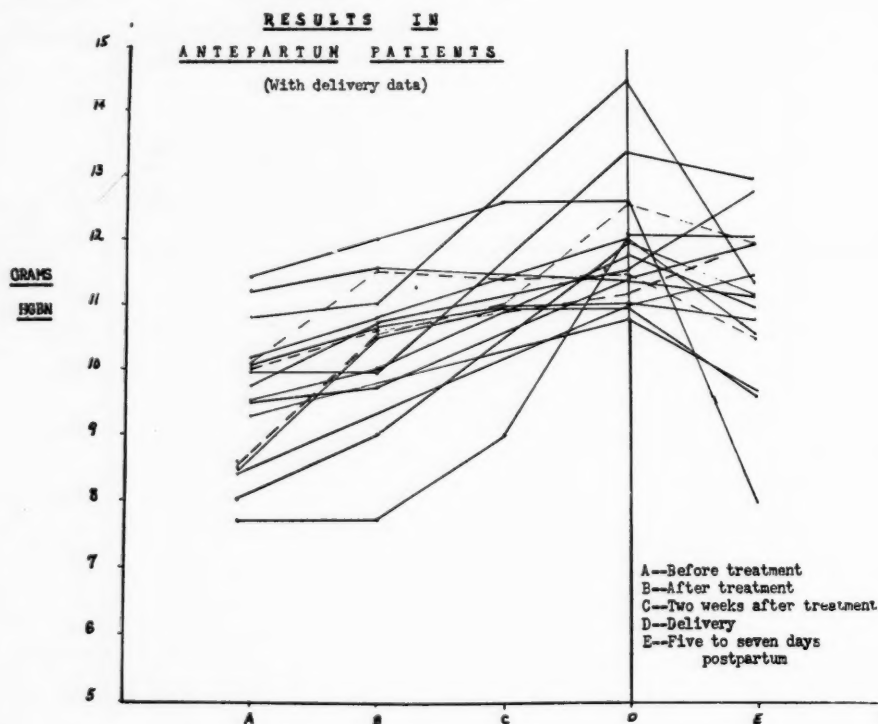E—Five to seven days
        postpartum

Fig. 4.

In Fig. 4, we have summarized the reactions in antepartum patients with delivery data. Our average elevation in hemoglobin in this group was 2.47 Gm. There were no patients in this group who showed no response to the treatment. The range in elevation of the hemoglobin level prior to delivery was from 1 Gm. to 4.25 Gm. Two patients' deliveries were accompanied by excessive blood loss, which explains the marked drop in the graph. However, on the whole, patients followed up to two weeks post partum showed a better hemoglobin level after delivery than they had before treatments were administered.

Four patients without disease were treated with the intravenous iron, all of whom responded and showed an average rise in hemoglobin level of 1.74 Gm.

To summarize the results in the entire group of patients studied, 85 per cent showed a favorable reaction within the two-week period they were observed. A questionable elevation in the hemoglobin level was found in 6 per cent of the cases, and 9 per cent showed no hematological response to the drug.

The results in the study of the mean corpuscular volume, mean corpuscular hemoglobin, and mean corpuscular hemoglobin concentration were inconclusive and showed no definite trends from which a conclusion could be drawn. Further studies are now being carried out in order possibly to throw some light on this matter.

This medication is of most value to those patients who register late in pregnancy for prenatal care and whose hemoglobin level is low. These patients cannot be relied upon to take medication at given intervals or every day, and a more suitable way must be found in order to increase the hemoglobin short of transfusion. While the appetite is capricious during pregnancy, and in some cases intestinal absorption may not be reliable, a parenteral method of administration may be indicated. In a large public ward service, where many abortion cases are admitted daily with evidence of chronic anemia, undernutrition, and acute blood loss, general dietary measures, along with parenteral iron, may be utilized. Of course, such iron therapy is not meant to eliminate whole blood transfusions, which are used freely and frequently. It will, however, supplement transfusion in more severe cases of anemia, or may eliminate it entirely in the more mild.

Summary

1. Sixty-seven patients were treated with 500 mg. of intravenous saccharated oxide of iron.

2. The results, in general, were favorable, with an average rise of 2 Gm. of hemoglobin per patient within two weeks.

3. Deleterious reactions to the drug were few and negligible and were seen only following too rapid administration.

4. A good response was seen in 85 per cent of the patients; 6 per cent showed a questionable response; and 9 per cent showed no hematological response at all.

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PREGNANCY AND MULTIPLE SCLEROSIS

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MULTIPLE sclerosis is an acute or chronic steadily progressive or remittent disease of unknown cause, involving chiefly the white matter of the central nervous system."[1] It is a syndrome known to medical science since its first description by Cruveilhier in 1835.[2] Since von Hoesslin published his survey and case reports in 1904,[3] it has been thought by many that the onsets and exacerbations occurring during pregnancy were the direct results of the pregnancy per se.

Prior to Tillman's[4] comprehensive review in 1950, there had been few American articles dealing with pregnancy and the disease. Atwell and MacKenzie[5] in 1934 described one case which progressed rapidly prior to and during pregnancy, but improved post partum. Peckham[6] in 1945 reviewed the literature and reported two cases, in one of which there was a recrudescence, and in the other no neurological change was noted during pregnancy. Birner[7] reported a case in 1945 with an exacerbation during the last trimester and a remission following delivery. Kushner[8] reported a case in 1946 in which pregnancy occurred 2½ years after the onset of the disease and had no effect on the disease. Tillman[4] reported 19 patients from the Sloane Hospital and 278 patients from the Neurological Institute in 1948, and found 52 patients with multiple sclerosis preceding pregnancy, 10 arising during a pregnancy, and 83 following pregnancy. Douglass and Jorgensen[9] in 1948 reported 5 cases and concluded that multiple sclerosis has no ill effects upon pregnancy or upon the offspring; and that pregnancy has little, if any effect on multiple sclerosis. Edwards, Edwards, and Tavenner[10] published a case in 1949 in which pregnancy had no effect on the disease. Baker[11] concluded from his case published in 1952 that multiple sclerosis had no effect on pregnancy nor pregnancy on multiple sclerosis.

This present study was undertaken in an attempt to determine the effect of multiple sclerosis on the pregnancies; and the effect of the pregnancies on the multiple sclerosis among the patients with this disease admitted to the New York Lying-In Hospital. An attempt was also made to determine the efficacy of therapeutic abortions in altering or improving the subsequent course of the disease.

Material

Since 1932 there have been 22 patients with the proved diagnosis of multiple sclerosis at the New York Lying-In Hospital. Only patients whose diagnoses have been confirmed by a neurologist are included. During the same

period there have been 80,558 patients discharged from the hospital or an incidence of 0.27 per thousand patients discharged.

There were 16 multigravidas and 6 primigravidas with 17 pregnancies prior to, and 36 pregnancies following the onset of the disease (Tables I and II). Tillman[4] states that his 19 patients had had 33 pregnancies before and 33 pregnancies after the onset of the condition. In this present group there were 52 pregnancies and 36 full-term and premature infants. There were 7 premature infants including one set of triplets and one set of twins. There were 11 spontaneous, 1 induced, and 4 therapeutic abortions.

TABLE I. NUMBER OF PREGNANCIES BEFORE AND AFTER THE ONSET OF MULTIPLE SCLEROSIS

	BEFORE THE ONSET				AFTER THE ONSET			
Number of pregnancies	1	2	3	5	1	2	3	4
Number of patients	2	2	2	1	11	9	1	1
Total pregnancies	2	4	6	5	11	18	3	4
Grand total pregnancies			17				36	

TABLE II. NUMBER OF DELIVERIES BEFORE AND AFTER THE ONSET OF MULTIPLE SCLEROSIS

	BEFORE THE ONSET				AFTER THE ONSET		
Number of deliveries	1	2	3	4	1	2	3
Number of patients	2	2	1	1	11	5	1
Total deliveries	2	4	3	4	11	10	3
Grand total deliveries			13			24	

There were 13 who had the onset of multiple sclerosis before any pregnancies. The shortest time between the onset and the initial pregnancy was one year and the longest 18 years. The average was 6.4 years (Table III). Six patients had the onset after one or more pregnancies. The longest time between the initial pregnancy and the onset was 14 years and the shortest 1 year. Three patients had the onset during a pregnancy, with 2 during the first pregnancy. Seven patients had from one to five pregnancies prior to the onset of the symptoms of multiple sclerosis. Twenty-two had from one to four pregnancies after the onset of the disease. Any given patient may have had pregnancies both before and after the onset of the disease and thus explain the discrepancy between the total number of patients and the total number in the breakdown (Table I).

TABLE III. TIME INTERVAL BETWEEN THE ONSET OF THE DISEASE AND THE INITIAL PREGNANCY

NO. OF CASES	YEARS BEFORE FIRST PREGNANCY																		YEARS AFTER FIRST PREGNANCY													
	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	x						x	x					x					x	x		x	x	x	x		x						x
2												x		x				x														
3																																
4													x																			

Age of Onset

Previous studies have dealt with the age of the patient at the time of onset of the disease. Sallstrom[12] reported 1,287 cases in 1942 and found 66 per

cent to have had the onset between the ages of 20 and 40 years. Kolb[13] re-
ported 199 cases in 1942 with 68 per cent in the same age group. The youngest
in this series was 11 years of age when symptoms first developed and the oldest
was 36. Approximately 75 per cent had the initial symptoms between the ages
of 20 and 30 (Table IV).

TABLE IV. AGE OF PATIENTS AT ONSET OF MULTIPLE SCLEROSIS

AGE GROUPS (YEARS)	NUMBER OF PATIENTS
Under 10	0
11-15	1
16-20	5
21-25	8
26-30	3
31-35	4
36-	1
Over 36	0

Antepartum Course, Labor, and Delivery

Three authors report cases in which the antepartum courses were asso-
ciated with obstetrical complications. Tillman[4] reported two patients with
severe pre-eclampsia; one with mild pre-eclampsia; and two with severe
nausea and vomiting. Douglass and Jorgensen[9] reported one of their patients
to have mild pre-eclampsia; and Baker[11] reported on a patient with premature
separation of the placenta. In this present series there were no significant
obstetrical complications except for two patients who had mild vomiting of
pregnancy.

Of the 20 deliveries at the New York Lying-In Hospital there were 14
spontaneous, 3 low forceps, 2 midforceps, and 1 breech delivery. There were
no cesarean sections. Among the pregnancies which were permitted to proceed
to natural termination there was only one fetal death, and this was one of the
triplets who died as a result of prematurity. Fourteen of these deliveries were
conducted under inhalation anesthesia employing nitrous oxide, oxygen, and
ether. The remainder were carried out with combinations of nitrous oxide,
oxygen, and local 1 per cent procaine.

The duration of the three stages of labor fell essentially within normal
limits. The average duration of the first stage was 9 hours; of the second
stage 64 minutes; and of the third stage 4 minutes.

None of the patients had a painless labor and the drugs employed for
analgesia included morphine, Demerol, scopolamine, and sodium pento-
barbital either alone or in combination. Only four patients did not receive
any drugs and these were patients with rapid or precipitous labors.

Atwell and MacKenzie[5] and Peckham[6] indicated that labor had been pain-
less in their cases. Tillman[4] reports one labor which had been painless until
36 minutes before delivery. He states that morphine, scopolamine, or one of
the barbiturates were employed for analgesia. He also found labor to be with-
in normal limits. Edwards, Edwards, and Tavenner[10] delivered their patient
by cesarean section under local procaine and Pentothal Sodium. Baker[11]

delivered his patient by cesarean section under spinal anesthesia. Douglass and Jorgensen[9] report that in 1 of their 5 cases, the patient had "three hours and 48 minutes of relatively mild labor, mostly back pains," and was delivered by low forceps. Kushner[8] recounts that his patient required analgesia during an 18 hour labor and ether for a low forceps delivery. All authors except Peckham and Atwell and MacKenzie seem in accord that patients with multiple sclerosis undergo normal labors and deliveries.

Therapeutic Abortions

Since the publications of von Hoesslin,[3, 14] Fleck,[18] Dimitz,[17] and other German writers,[15, 16] the tendency among the neurologists and obstetricians had been to recommend interruption of the pregnancies of patients with multiple sclerosis. The more recent American writers, however, have found little indication for therapeutic abortions in this disease. Peckham[6] states that, "if the condition is far advanced or is progressing more rapidly since the onset of gestation, abortion should be advised. If the disease is in its early stages and shows no evidence of exacerbation, the pregnancy may be allowed to continue." Tillman[4] reports 12 interruptions, 2 by dilatation and curettage, 3 by hysterectomy, and 10 by hysterotomy and tubal sterilization. Eight had exacerbations ranging from within three weeks to 1½ years following operation. He states that the results indicate that, as far as the disease is concerned, nothing is to be gained by interruption since recrudesence will still occur. Douglass and Jorgensen[9] report 2 cases in which a therapeutic abortion was done. It is their opinion that pregnancy has little, if any, effect on multiple sclerosis; and that multiple sclerosis is not an indication for a therapeutic abortion.

There have been 3 vaginal therapeutic abortions and one hysterotomy performed at the New York Lying-In Hospital for multiple sclerosis. Three of the patients also had tubal sterilizations. One of the patients had the onset of the disease five years before the first pregnancy and had had two exacerbations and remissions before the onset of pregnancy. A pregnancy was interrupted, but within a year she began to have further exacerbations. The second patient had the onset of the disease ten years before her first pregnancy and was in complete remission when she became pregnant. A therapeutic abortion and tubal sterilization were performed. The third patient had had three uneventful pregnancies prior to the onset of the disease during her fourth pregnancy. The fifth pregnancy followed with no recurrence of the symptoms, but the sixth coincided with another recurrence which was again followed by remission and improvement. A seventh pregnancy resulted in a return of her symptoms and a therapeutic abortion and tubal sterilization were performed. Following complete remission, the patient had two further exacerbations, the latter resulting in complete invalidism. The fourth patient had had five pregnancies before the onset of a rapidly progressive disease at the age of 36. Two years later she became pregnant and was admitted to the hospital where a hysterotomy and tubal sterilization were performed. She continued her downhill course and died six months following operation.

Natural Course of the Disease and Its Relationship to Pregnancy

All authors agree that multiple sclerosis may begin suddenly with a single minor symptom; as an acute fulminating and incapacitating illness; or it may begin as an insidiously progressive disease with or without fluctuations and remissions.[19] They further agree that the identifying features of the disease are first, the discreteness and multiplicity of lesions, and second the reversibility of earlier lesions permitting complete or partial recovery. In one large group, remissions to the point of practical recovery occurred in 17 per cent, including 2 per cent whose remissions lasted 14 to 43 years.[14] In another, there was complete recovery from the first symptoms in 44 per cent with another 26 per cent having later remissions.[21] Thygeson[22] reports on a large group who were followed for eight to fifteen years after the onset and found one-half disabled, one-fourth dead, but one-fourth practically well. In a large group of autopsy-proved cases, remissions occurred in 59 per cent of the cases.[23] These features have earned for the disease such characterizations as "a disease scattered in time and space," and "a disease of remissions and exacerbations." There were 17 patients in this series whose 38 pregnancies effected neither the onset nor the course of the disease. Two felt improved during pregnancy.

Three had the onset of symptoms during a pregnancy. One during the first trimester of her first pregnancy followed by a remission. Two subsequent pregnancies followed without exacerbation, but between and unrelated to the pregnancies she had three exacerbations and remissions. The second had the onset six weeks post partum after her first pregnancy. This was followed by a remission and no further pregnancies or known exacerbations. The third patient had the onset during her fourth pregnancy. She had exacerbations during two subsequent pregnancies and had a therapeutic abortion performed. She then continued to have exacerbations to the point of invalidism seven years after the interruption. Therefore, although the disease began with one particular pregnancy, two of the patients had later pregnancies which did not affect their condition, and had exacerbations unrelated to pregnancies.

Three patients noted recurrences during a pregnancy. One has been included in the preceding group. The second had the onset three years prior to her first pregnancy during which she had an exacerbation followed by a remission. A subsequent pregnancy was without recrudescence or progression. The third patient had the onset one year after her first pregnancy. A second pregnancy resulted in an exacerbation, but a third did not. These three patients whose disease was affected by a particular pregnancy had other pregnancies with no change in their neurological disorder and two patients had recurrences unrelated to pregnancy.

Comment

It is estimated that 50 to 100 thousand persons in the United States have multiple sclerosis. This represents, therefore, an important disease both medically and economically. If there will be, as is estimated, four million

term and premature deliveries in the United States during the next year, the importance of attempting to determine the relationship of pregnancy to the disease becomes apparent.

More than half of the patients in this series had the onset before any pregnancies, and almost two-thirds had exacerbations unrelated to pregnancies. It is difficult to establish pregnancy as the etiological agent in the onset or recurrence in these cases. In the 5 with the onset or recurrence during a particular pregnancy, 4 also had recurrence unrelated to pregnancy, and 3 had later pregnancies without recurrence. The results of this study would indicate that the onset and the recrudescence which occur during pregnancy may not actually represent a cause-and-effect relationship, but may represent a purely chance relationship. It does not seem reasonable to consider pregnancy as the exciting factor in the onset of multiple sclerosis or the stimulant of the exacerbations of the disease for, as we have shown, the onset or the exacerbations are not limited to pregnancy nor are the pregnancies in women with the condition always associated with either the onset or the exacerbations. Indeed, the disease is not limited to pregnant women or even to women, but occurs equally often in men.

I have been unable to find that multiple sclerosis has any adverse effect on pregnancy. The results indicate that patients with this condition undergo completely normal pregnancies and deliveries with no increase in any obstetrical complications. I do not agree that the labors are painless or that inhalation anesthesia is detrimental[20] and feel that the labors and deliveries may be conducted under the same regimen as the labors and deliveries of those patients without the disease. Furthermore, a patient with multiple sclerosis who becomes pregnant may anticipate as great a chance of having a healthy child as does any pregnant patient who does not have the disease. This study would indicate, therefore, that the diagnosis of multiple sclerosis is not a medical indication for a therapeutic abortion. In this survey three of the four patients whose pregnancies were interrupted continued to follow the natural course of the disease with subsequent remissions and exacerbations unrelated to pregnancy. I feel, therefore, that nothing is to be gained from interrupting a pregnancy in a patient with multiple sclerosis, because the disease will have no effect on the pregnancy and the pregnancy will not affect the ultimate course of exacerbations and remissions which are so characteristic of this disease.

Summary and Conclusions

1. Twenty-two patients with multiple sclerosis and pregnancy are reported. In 17, pregnancy did not affect the disease. Five had the onset or an exacerbation during a pregnancy.

2. In 13 the onset was before any pregnancy. In 6 the onset was after one or more pregnancies. In 3 the onset was during a pregnancy. This report would indicate that pregnancy cannot be considered the exciting factor of multiple sclerosis.

3. In the 17 in whom pregnancy did not adversely affect the disease there were 2 who felt improved during a pregnancy. Twelve had exacerbations unrelated to pregnancy.

4. In the 5 with the onset or exacerbation related to pregnancy, 4 also had exacerbations unrelated to pregnancy, and 3 had subsequent pregnancies with no exacerbations.

5. The youngest at the age of onset was 11 years of age and the oldest 36. Approximately 75 per cent had the initial symptoms between the ages of 20 and 40.

6. There were 52 pregnancies and 36 full-term or premature infants. There were 7 premature infants with one set of triplets and one set of twins. There were 11 spontaneous, 1 induced, and 4 therapeutic abortions. In these patients there appears to be no associated sterility.

7. All patients whose pregnancies proceeded to natural termination had normal antepartum courses, labors, and deliveries. Multiple sclerosis does not appear to have any adverse effect on pregnancy.

8. Four therapeutic abortions were performed for multiple sclerosis. Three of the 4 patients continued to follow the natural course of the disease with subsequent exacerbations and remissions. There is no indication that anything is to be gained by interrupting a pregnancy in a patient with multiple sclerosis for exacerbations and remissions may still occur.

9. The disease is characterized by exacerbations and remissions, and there is no evidence that pregnancy affects the ultimate course of the disease.

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PROGRESS IN THE REDUCTION OF NEONATAL MORTALITY*

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THE persistence of a high neonatal death rate, in spite of a constantly falling general infant mortality, offers a challenge to both obstetricians and pediatricians.

During the past few years the newborn has become the subject of renewed interest and investigation. Considerable progress has been made toward solving many of the problems concerned with neonatal mortality.

Much of this progress may be ascribed to three factors: First, recent clinical and laboratory investigations of the physiology, biochemistry, and pathology of the fetus and newborn have added greatly to our knowledge of their physiological and biochemical peculiarities and improved our understanding of the normal and pathological reactions. Second, a new concept of the newborn, partly the cause and partly the effect perhaps of these recent clinical and laboratory investigations, has gradually taken shape. "This is the realization that the newborn infant is really not new at all when born!"[1] He is only newly born. Life for the infant begins with the fertilization of the ovum and proceeds in a constant pattern, unless interrupted, to maturity. The neonatal period is thus merely a merging of prenatal and postnatal physiology as influenced by the adjustments made necessary by birth. Third, obstetricians and pediatricians have come to realize that the welfare of the newborn, from a medical point of view, is a joint responsibility in which each has an important role. This cooperation of obstetricians and pediatricians has grown from the obvious fact that many of the causes responsible for a large number of neonatal deaths are the same causes responsible for a large proportion of fetal deaths. Factors tending to alter the incidence of one seldom fail to affect that of the other. Because of this interrelation, the obstetrician cannot be uninterested in the infant's condition once he has delivered the child alive, nor can the pediatrician be unconcerned with factors which may jeopardize the existence of the child in utero.

In attempting to evaluate the causes of neonatal mortality it is quite apparent that one cannot consider neonatal deaths and stillbirths separately. Many studies analyzing the causes of fetal and neonatal death have been made within the past few years. The results show a remarkable degree of similarity. Prematurity, anoxia, malformations, birth injury, infections, and hemorrhagic conditions are consistently found to be the major causes.

It is obviously impossible to consider in detail all of these various conditions. This paper is limited, therefore, to a brief discussion of a few of the more common conditions which most frequently cause neonatal death.

Prematurity is still the leading cause of infant death—this, in spite of tremendous advances in the postnatal care of prematurely born infants.

Relatively little is known concerning the factors responsible for premature birth. Studies stressing the influence of antepartum nutrition, socioeconomic factors, general hygienic habits, and environment and maternal injury on the status of the infant at birth and emphasizing antepartum care indicate a potential approach to the prevention of premature birth.

Further reduction in premature mortality may be achieved by intensification of research along these lines. The recent conference on Pregnancy Wastage, the pilot studies of Wallace, Roscoff, and Knobloch[2] and the report of Baumgartner[3] are constructive steps in this direction.

The prognosis of premature infants, especially if the birth weight is below 1,500 grams, seems dependent more on maturity than on absolute weight. Our efforts should be directed, therefore, not only toward lowering the incidence of premature birth but also to the prolongation of intrauterine life.

Except for those with important congenital anomalies, prematurely born infants who today survive more than four days after birth will most likely continue to do so. Our efforts, therefore, should be concentrated on the critical first 96 hours, during which we still must rely primarily on the prevention of trauma, anoxia, and narcosis during delivery, and on gentleness, maintenance of body heat, the free use of oxygen and humidity, and skilled nursing care immediately thereafter.

In the premature nursery, it is particularly important that there be one supervisor in control. Best results are obtained when an exact routine is followed, and is not changed by each attending physician who wants to try his own pet ideas.

Undoubtedly the most frequent pathological condition encountered in the neonatal period is that of anoxia.

The resuscitation of the newborn remains primarily the responsibility of the obstetrician. Subsequent pediatric care, however, may be improved if the pediatrician is fully aware of what factor or factors, antenatally or natally, have, in the judgment of the obstetrician, been responsible for the anoxia and what methods were employed in resuscitation.

From the pediatric standpoint, gentleness in handling the infant cannot be too strongly emphasized. Direct laryngoscopy and bronchial drainage are seldom indicated and may be injurious. It should be stated, however, that, in the occasional incident, if a highly trained team is available, such procedures may be lifesaving. Mechanical respirators, such as are available today, and the use of positive pressure in expanding the alveoli are unphysiological, futile, and dangerous. The so-called respiratory stimulants have a very limited usefulness and may be harmful.

It has been shown recently that inflation of the stomach with oxygen,[4] to be absorbed by the gastric mucosa, is effective despite apnea or insufficient respiration. Such a procedure is simple, may be carried out by untrained assistants, and warrants further investigation.

Infants delivered by cesarean section seem to have a disproportionately higher incidence of asphyxia and are particularly prone to respiratory difficulties.

The cause of this so-called postcesarean syndrome is not clear. It is possible that it may be essentially a mechanical consequence of aspiration. Frequently these babies have an excessive amount of secretion in the airways and in the stomach which may be vomited or aspirated. For some time now, in addition to the careful cleansing of the air passages, we have been routinely aspirating at birth the stomachs of all infants born by section. It is our impression that the procedure is of value.

The importance of maternal analgesia and anesthesia in contributing to neonatal depression and anoxia is well recognized. With a better understanding of their danger and more judicious care in their use, particularly in premature birth, further progress will be made in reducing the incidence of asphyxia of the newborn. In this connection, the introduction of n-allylnormorphine to combat neonatal narcosis may prove of significant value.

Any infant who has been exposed to even a short period of anoxia should be kept in an atmosphere of 50 to 60 per cent oxygen with a humidity approximating 80 per cent for at least 12 to 24 hours. Suction equipment should be constantly at hand and used to remove all excessive secretion. It is most important that these infants be checked at frequent intervals by the nursery personnel. Antibiotics are given routinely to all infants subjected to tracheal catheterization and in cases where there has been an early rupture of the amniotic sac. We are not greatly concerned about hydration during the first several days. Many anoxic babies develop some edema. The administration of fluids at this time may do more harm than good. Later, if the baby cannot be fed, they are necessary. Oral feedings are started only after the respiratory distress has been relieved.

In the past few years we have become increasingly aware of the pathological condition associated with the formation of a hyaline membrane and resorption atelectasis. Potter[5] finds this condition the most frequent cause of neonatal death at the Chicago Lying-in Hospital. The clinical and pathological findings are characteristic and, when recognized, are rarely confused with those of any other disease. It is much more frequent in prematures and in infants delivered by cesarean section. The infant may breathe spontaneously and appear normal at birth. Shortly after, respiration becomes labored and cyanosis develops. Breath sounds gradually become less audible. Occasionally respiration improves and recovery takes place. More often death occurs, usually in a few hours.

The pathological picture is identical in all cases. There is a widespread resorption of air and the inner surfaces of the alveoli and alveolar ducts are covered by an irregular layer of homogenous, acidophilic material which forms a mechanical barrier to respiratory exchange. The origin of this substance has not been definitely established.

There is no specific treatment. The incidence of hyaline membrane seems to be reduced, however, by placing all infants with respiratory distress in an atmosphere of 50 to 60 per cent oxygen with 80 to 90 per cent humidity.

Infants with hyaline membrane disease, if they survive, may develop pneumonia. It is wise, therefore, in these cases to start antibiotic therapy early.

Congenital malformations represent an important cause of fetal and neonatal death.

During the past few years, however, due to better surgical technique, the outlook for infants with certain congenital anomalies of the gastrointestinal tract has improved tremendously. The most frequent of these anomalies amenable to treatment are tracheobronchial fistula, intestinal atresia, diaphragmatic hernia, and imperforate anus. Early recognition of these defects is imperative. Delay in surgical intervention is associated with a marked increase in mortality.

The great advances in cardiovascular surgery, while not directly applicable to newborn infants, offer new hope for many of the infants with congenital cardiac anomalies.

A few years ago the prevention of congenital malformations was an intractable problem of preventive medicine. Even now the origin of the majority of human congenital anomalies remains obscure and prevention is limited to a few specific instances in which the etiology is known. However, with Warkany's[6] experimental studies on nutrition, the incrimination of certain infections, especially the virus of rubella, in the causation of various anomalies, the well-known effects of radiation, and Ingalls'[7] recent demonstration of the specific effects resulting from brief exposures of the fetus to anoxia, the whole problem of malformations is undergoing change and clarification.

As soon as the etiology is established, prevention of malformations caused by environmental factors may become practicable.

Although birth trauma has been reduced significantly, intracranial hemorrhage still remains an important cause of morbidity and mortality during the neonatal period. Intracranial hemorrhage may occur in spontaneous deliveries but usually results from trauma, anoxia, and occasionally hypoprothrombinemia. Faber found a high incidence of prenatal factors responsible for cerebral injury in cases of cerebral atrophy.

It cannot be too strongly emphasized that the infant suffering from intracranial injuries should be handled as little as possible. Our fault is often one of too much, rather than too little, therapy. Oxygen, heat, and quiet are the chief therapeutic points to be kept in mind during the critical first 72 hours of life. Oral administration of fluids should be withheld until the sucking and swallowing reflexes are well established.

Infection as a cause of neonatal mortality is rapidly diminishing. The prime objective of treatment of infections of the newborn is to prevent their occurrence.

Epidemic diarrhea is probably the most dreaded of infections of the neonatal period. So far no single causative organism has been discovered. It is probably due either to a virus invading the intestines or to infections with various organisms, some of which, like *Escherichia coli,* the paracolon bacillus, and Pseudomonas, are not ordinarily considered to be pathogenic.

Prevention of the disease by means of rigid cleanliness in the nursery, aseptic nursing technique, and isolation of the baby from a mother who has any infection, vomiting, or diarrhea promises the greatest protection of these infants. Immediate quarantine of a suspected subject, isolation of exposed infants, and no further admission to the infected nursery are essential measures.

The advent of the sulfonamides and antibiotics has been of tremendous value in the management of infections occurring in the neonatal period. Their availability, however, should not be allowed to encourage complacency in respect to neonatal infections nor have the advances in antibacterial therapy relieved the physician of the responsibility of prompt and accurate diagnosis. It should be remembered that these drugs are capable of producing untoward effects. There is always the possibility of sensitization, and the prolonged and indiscriminate use of antibiotics may result in the emergence of a flora of resistant organisms, more troublesome than the original pathogen.

Erythroblastosis is the most important of the hematological diseases encountered in the neonatal period. Reduction in deaths from erythroblastosis requires a definite plan and the complete cooperation of the obstetrician, the pediatrician, and the serologist.

Such a plan should include, first, a detailed history in every pregnancy of any possible sensitization and complete antenatal serologic studies. Second, the responsible pediatrician should be notified of the impending delivery of any Rh-negative woman with a positive titer and be present for the delivery. Third, a well-organized exchange transfusion team should be immediately available for all emergencies. Fourth, examination of the cord blood should be done in every case.

At birth the diagnosis must be made, the severity of the disease classified, and the choice of treatment determined.

The essential criteria for the diagnosis of erythroblastosis are the demonstration of maternal sensitization and the presence of a positive coating reaction and anemia in the blood of the infant.

The clinical condition of the infant is the most important criterion of the severity of the disease. Our ultimate decision as to therapy, however, must also take into consideration the cord blood findings, the maternal reproductive history, and the maternal antibody titers.

There still exists some difference of opinion as to when exchange transfusion should be used. Present evidence seems to show beyond a reasonable doubt, however, that if we are going to reduce our mortality in erythroblastosis and reduce the incidence of kernicterus, we must broaden our criteria for the use of exchange transfusion.

Exchange transfusion should be done immediately if an Rh-positive baby of a sensitized Rh-negative mother shows clinical evidence of the disease on

physical examination, or of such anemia as to make possible an unequivocal diagnosis of clinical erythroblastosis.

If an Rh-positive baby of a sensitized Rh-negative mother has no clinical signs of illness at birth, an exchange transfusion probably should be done if the maternal titer is 1 to 16 or above, if the baby is of less than 38 weeks' gestation or if there is a past history of serious or fatal erythroblastosis in a previous infant.

If an exchange transfusion is not elected or done immediately after birth, it should be done at the earliest opportunity if jaundice appears during the first 24 hours of life.

If, after an initial exchange transfusion, an infant with erythroblastosis shows increasing jaundice, or if the bilirubin level is above 20 mg. per cent, a second exchange should be carried out.

Just a word with reference to infants born of diabetic mothers. The special problem of these infants was for a long time considered to be related chiefly to hyperinsulinism. It is now clear, however, that, although hypoglycemia is frequently greater than in infants born of nondiabetic mothers, it is seldom the cause of death. Other factors, resulting from prenatal environment and natal experience, are more often responsible for the high neonatal mortality.

The proper management of these infants includes prenatal and natal as well as postnatal care. The prenatal care is good treatment of the diabetes. Substitutional hormone therapy, except for insulin, appears of questionable value. Natal care is the selection of the type of delivery most favorable for the infant, administration of oxygen during surgical deliveries, and the restriction of sedation. Postnatal care includes immediate thorough clearing of the airways, postural drainage, dehydration through restriction of fluids, and the administration of oxygen as long as indicated. All these babies should be handled as prematures. To prevent hypoglycemia, the oral administration of 1 to 2 c.c. of 50 per cent glucose may be started shortly after birth. If symptoms of hypoglycemia develop, glucose intravenously or subcutaneously with or without epinephrine should be used.

It is obvious that the further reduction in neonatal mortality is dependent upon various factors: (1) reduction of the incidence of premature birth and prolongation of intrauterine life; (2) increasingly efficient obstetric technique and better understanding of the importance of maternal analgesia and anesthesia in predisposing to neonatal hypoxia; (3) continued teratogenic research followed by the application of coordinated clinical and experimental investigations; (4) continued studies on the physiology and pathology of the fetus and the newborn; (5) the prompt recognition and treatment of pathological conditions which occur in the neonatal period; (6) and, last but not least, increasing cooperation between the obstetricians and pediatricians so that the newborn infant may have the full benefit of the combined knowledge and experience of the two specialties.

I would like to emphasize the importance of the setup of a service for the newborn headed by a pediatrician who must assume the responsibility for its organization and management; the importance of preparedness and promptness in initiating indicated procedures; the importance of the pediatrician's being cognizant of any antenatal or natal factors which may adversely affect the child at birth; the importance of alert and continuous observation of all newborn infants; the importance of accuracy in diagnosis and gentleness in the management of all newborns; the importance of avoiding overenthusiastic therapy, especially in infants suffering from asphyxia and intracranial injury; and, finally, the importance of developing pediatrically minded obstetricians and obstetrically minded pediatricians so that together we may work toward the solutions of our mutual problems.

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A STUDY OF FIVE HUNDRED EIGHTEEN CONSECUTIVE HYSTERECTOMIES

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THE trend toward complete hysterectomy is well established.[1-3] Our experience has shown that total hysterectomy can, in addition, be completely safe from the patient's standpoint regardless of the type of pelvic pathology. There yet remain, however, the problems of morbidity and route of operation. The purpose of this study is to review the results of a series of cases and to determine methods of reaching these goals.

Material

Five hundred eighteen consecutive hysterectomies are presented, with a follow-up of one to eight years. These patients are taken from the private practices of two of us (J. H. C. and L. P. T.) from 1944 to 1950; in addition, a few Service patients who were treated by us are included.

The data concerning the 518 patients who were operated upon are presented in the following sixteen tables, with a commentary on each table when indicated.

TABLE I. Constitution of the Entire Series of 518 Patients

TYPE OF OPERATION	NUMBER OF PATIENTS	PERCENTAGE
Abdominal hysterectomy	483	93
Total abdominal hysterectomy	479	99 { of abdominal
Subtotal abdominal hysterectomy	4	1 } hysterectomies
Total vaginal hysterectomy	35	7

The four patients undergoing subtotal hysterectomy were the following:

The first was a 48-year-old woman who complained of pelvic pain and a sense of weight in the pelvis. Cystocele and uterine myomas were present. Anterior vaginal plastic and appendectomy were performed, with subtotal hysterectomy. The subtotal operation was done to avoid disrupting the repair of the anterior vaginal wall. The operating time was 65 minutes. The postoperative course was morbid. The patient died on the seventh day from concealed hemorrhage from the appendiceal artery. Postmortem examination was performed.

The second was a 39-year-old woman who complained of menorrhagia. The preoperative diagnosis was myomas of the uterus. A bicornuate uterus with a rudimentary horn, and a papillary serous cystadenoma of the ovary

TABLE II. PRESENTING SYMPTOMS, 518 PATIENTS

Among 35 Patients Who Underwent Vaginal Hysterectomy.—

Procidentia	25 patients, 71%
Abnormal vaginal bleeding	3
Stress incontinence	2
Combination of symptoms	5

Among 483 Patients Who Underwent Abdominal Hysterectomy.—

Lower abdominal and/or pelvic pain	116
Menorrhagia	111
Abnormal bleeding associated with pain	96
Menometrorrhagia	45
Sensation of weight in the pelvis	23
Postmenopausal bleeding	21
Combination of three or more symptoms	20
Pelvic pain and vaginal discharge	11
Metrorrhagia	10
Dysmenorrhea	9
No symptoms*	8
Vaginal discharge	5
Backache	4
Postpartum hemorrhage	3
Urinary incontinence, constipation and diarrhea, mass in the vagina, and frequency of urination	1 each

*This group included patients investigated for infertility or for asymptomatic pelvic tumors.

TABLE III. INDICATION FOR OPERATION—518 PATIENTS

Vaginal.—

Physical signs of procidentia	30
Cystocele and/or rectocele	3
Hypertrophy of uterus with pelvic symptoms and minor degree of prolapse	2

Abdominal.—

Myomas of the uterus with abnormal vaginal bleeding and/or pain	167
Hypertrophy of uterus with pelvic symptoms	88
Pelvic inflammatory disease residual	41
Adhesions of abdominal or pelvic peritoneum	31
Fibrosis of myometrium with abnormal bleeding and/or pain	27
External endometriosis	20
Ovarian cyst	18
Cystocele and/or rectocele	15
Severe chronic cervicitis	13
Carcinoma of the endometrium	13
Procidentia	7*
Internal endometriosis (adenomyosis)	7
Congestion-fibrosis syndrome	6
Radiation-treated carcinoma of the cervix	5†
Ectopic pregnancy	3
Endometrial hyperplasia	4
Appendicitis (which at operation was found to be, respectively, external endometriosis, pelvic inflammatory disease, and degenerating uterine myoma)	3
Postpartum hemorrhage	3
Pelvic tumor of undetermined type	2
Postoperative stenosis of the cervix	2
Pregnancy with decompensating rheumatic heart disease, pregnancy with chronic nephritis, borderline carcinoma of the cervix, perforation of the uterus, retroversion of the uterus, tuberculous endometritis, chronic endometritis, postmenopausal bleeding of undetermined cause	1 each

*Generally speaking, we remove the uterus by the vaginal route only when the cervix can be pulled down to the introitus or farther without anesthesia.

†One of these patients did not receive preoperative radiation. This patient has been presented above, among the group of subtotal hysterectomies.

were found at operation. Because of technical difficulty, a subtotal hysterectomy was done. The operative time was 55 minutes. The postoperative course was uneventful. The cervix was removed vaginally one year later because of spotting.

The third was a 38-year-old patient with menometrorrhagia. A Stage I epidermoid carcinoma of the cervix was found. An attempt was made to perform a Wertheim type of hysterectomy, but, due to technical difficulty, the operation ended as a dismal subtotal hysterectomy without lymph node dissection. The operating time was 90 minutes. The postoperative course was morbid, with wound infection. Radium application and deep x-ray therapy were used subsequently. The patient remained in the hospital 88 days. She died within one year of operation.

The fourth was a 36-year-old parturient who was moribund with a severe postpartum hemorrhage. Subtotal hysterectomy was done in 40 minutes of operating time, and the patient lived. The cause of the hemorrhage was not evident on pathological examination. This patient developed homologous serum jaundice, apparently due to one of the several transfusions which she received. No attempt was made to remove the cervix at a later date.

As Greenhill[4] states, there has been an increasing trend throughout the United States in the past fifteen years to treat carcinoma of the cervix by radiation, and to follow this with radical surgery.

TABLE IV. AGE RANGE, 518 PATIENTS

	AVERAGE AGE	RANGE
Vaginal hysterectomy	57 years	31-76 years
Abdominal hysterectomy	40 years	20-79 years

TABLE V. PARITY, 441 PATIENTS

Uterus Removed Vaginally.—
    No nullipara
    Average, 4 term pregnancies each
    Range: 1 to 10 term pregnancies each

Uterus Removed Abdominally.—
    61 nulliparas
    Average, 2 term pregnancies each
    Range: 0 to 13 term pregnancies each

TABLE VI. PREVIOUS OPERATIONS, 518 PATIENTS

Appendectomy	166 patients
Major gynecological operations	135 patients
Minor gynecological operations, including radium insertion	91 patients
Cesarean section	12 patients
Other operations (rectal, cholecystic, etc.)	85 patients

Our standard for morbidity is an oral temperature of 100.4° F. or higher, on two or more consecutive days after the first postoperative day. Antibiotics are not routinely used.

The two patients who died postoperatively were the following: The first has already been presented with the group of subtotal hysterectomies. The

patient died on the seventh postoperative day from concealed hemorrhage from the appendiceal artery, revealed by postmortem examination.

The second was a 47-year-old unipara with menorrhagia of one year's duration. Myomas of the uterus were found. A total abdominal hysterectomy and bilateral salpingo-oophorectomy were performed. The patient had signs of massive pulmonary embolism on the tenth postoperative day, which she survived, only to die seven days later from a second massive embolism while preparing for discharge. Postmortem examination was not obtainable.

All myomas mentioned in this study were leiomyomas.

TABLE VII.   ADDITIONAL OPERATIVE PROCEDURES, 518 PATIENTS

With Vaginal Hysterectomy.—	
Anterior and/or posterior vaginal plastic procedure	31
Total colpocleisis	1
No additional procedure	3
With Abdominal Hysterectomy.—	
Appendectomy	238
Unilateral salpingectomy and/or oophorectomy	128
Bilateral salpingo-oophorectomy	110
Lysis of adhesions	103
Vaginal plastic procedure	49
No additional procedure	48
Resection of ovarian cyst	42
Bilateral salpingectomy	42
Dilatation and curettage of uterus	25
Repair of various hernias	10
Hemorrhoidectomy	8
Biopsy of pelvic peritoneum	8
Pelvic lymph node dissection	4
Excision of cyst of Bartholin's gland, excision of broad ligamentous cyst, excision of tumor of breast, repair of enterocele, vaginal myomectomy, and cesarean section	2 each
Parovarian cystectomy, colostomy, liver biopsy, excision of keloid of leg, presacral neurectomy, nephropexy, repair of bladder laceration, excision of sigmoidal myoma, simple mastectomy, cystotomy with repair and transplantation of ureters, dilatation of anus, cautery of endometrial implants, suspension of ovary	1 each

TABLE VIII.   OPERATING TIME, 518 PATIENTS

Vaginal Hysterectomy With Additional Procedures.—
    Average duration of operation, 86 minutes
    Range of duration of operation, 53-155 minutes

Abdominal Hysterectomy With Additional Procedures.—
    Average duration of operation, 69 minutes
    Range of duration of operation, 30-185 minutes

TABLE IX.   OPERATIVE COMPLICATIONS, 518 PATIENTS

With Vaginal Hysterectomy.—	
None	
With Abdominal Hysterectomy.—	
Laceration or contusion of bowel	2
Laceration of bladder	1
Transection of ureter	1

At the present time, patients having hysterectomy with uncomplicated recovery leave the hospital on the seventh day. Almost all patients are out of bed on the first postoperative day.

TABLE X. POSTOPERATIVE COMPLICATIONS, 518 PATIENTS

Following Vaginal Hysterectomy.—	
Postoperative parametritis at the vaginal cuff, with or without abscess formation	6 noted
Cystitis	4 noted
Ureterovaginal fistula, hematoma of the broad ligament, pyelitis	1 each
Following Abdominal Hysterectomy.—	
Postoperative parametritis with or without abscess	10 noted
Cystitis	9 noted
Wound infection	6
Superficial or deep thrombophlebitis	4
Hematoma of incision	3
Pulmonary atelectasis	3
Vesicovaginal fistula, evisceration, acute bronchitis	2 each
Bleeding from appendiceal artery, bleeding from ovarian artery, pulmonary embolism, stitch abscess, urinary retention, ureterovaginal fistula, pyelitis, enteritis, rectovaginal fistula, mild cardiac decompensation	1 each

TABLE XI. MORBIDITY RATE, 518 OPERATIONS

Following 35 vaginal hysterectomies: 54%
Following 483 abdominal hysterectomies: 36%

TABLE XII. MORTALITY RATE, 518 HYSTERECTOMIES

Following vaginal hysterectomy: 0%
Following abdominal hysterectomy: 0.4% (2 deaths)

Very few patients were lost to follow-up examination of at least six months.

Follow-up data were collected in a few instances from hospital readmission charts, but in most instances were provided by the office records of two of us (J. H. C. and L. P. T.).

We use no fixed rule for total removal of the adnexa according to age, but consider such other factors as evidence of ovarian function, presence of ovarian or oviducal abnormality, previous operations, the indication for hysterectomy, and the patient's psychic make-up.

Technique

For abdominal hysterectomy, we use the following technique with minor variations according to the pathology present, and according to vagaries of human nature. When the ovary is removed, the infundibulopelvic ligament is clamped, suture-ligated, cut, and the pedicle religatured. When the ovary is conserved, the ovarian ligament, Fallopian tube, and mesosalpinx in a bundle are treated in a similar manner. The round and broad ligaments are then singly suture-ligated and cut. The opposite adnexa are treated as necessary. A bladder flap is developed, as well as a posterior peritoneal reflection. The uterine vessels are clamped at the internal os, cut, and suture-ligated twice. The cardinal ligaments are serially clamped with the uterosacral ligaments paracervically with straight Ochsner clamps, cut, and suture-ligated down to the vagina. In cases of extensive endometriosis involving the rectovaginal septum and cervix, the latter must be dissected out of its peritoneal and fascial coats. The pericervical fascia is dissected down by scalpel, and

TABLE XIII.   PATHOLOGICAL DIAGNOSES, 518 HYSTERECTOMIES

With Vaginal Hysterectomy.—	
Chronic cervicitis was universal	
Hypertrophy of the uterus	17
Myomas of the uterus	8
Atrophy of the uterus	8
Endometrial polyposis	5
Fibrosis of uterus	5
Endometrial hyperplasia	3
Acute endometritis	1
Adenomyosis of the uterus	1
With Abdominal Hysterectomy.—	
Chronic cervicitis was universal	
Hypertrophy of the uterus	249
Myomas of the uterus	188
Chronic salpingitis	70
Uterine serosal adhesions	45
Fibrosis of uterus	38
Endometrial polyposis	34
Corpus luteum cyst	33
Follicular cyst	32
Endometrial hyperplasia	31
Chronic metritis or perimetritis	28
Adenomyosis of the uterus	22
Endometriosis of ovary	19
Endometriosis of pelvic peritoneum	19
Chronic appendicitis	18
Carcinoma of the endometrium	13
Cervical polyp	12
Cesarean section scar in uterus	12
Acute or chronic endometritis	9
Pyosalpinx	8
Acute salpingitis	8
Endometrial dysplasia	8
Uterine pregnancy	7
Carcinoma of cervix	6
Endometriosis of Fallopian tube	5
Hydrosalpinx	5
Atrophy or fibrosis of ovary	3
Acute cervicitis	3
Atrophy of the uterus	3
Tuberculosis of endometrium	3
Borderline carcinoma of cervix	2
Endometriosis of uterus, teratoma of ovary, endosalpingi-oma of ovary, oviducal pregnancy, acute appendicitis, oxyuriasis of the appendix, tubovarian abscess	2 each
Foreign body giant cells in cul-de-sac, crystalline deposit in the peritoneum, tuberculosis of uterus, tuberculosis of cervix, situs inversus, rudimentary horn of uterus, bicornuate uterus, endometriosis of cervix, endometriosis of appendix, carcinoma of rectum, tuberculosis of appendix, interstitial pregnancy, retained secundines, tuberculosis of Fallopian tube, fibrosis of tubes, sarcoma of uterus, myoma of cervix, leukemic infiltration of uterus, stenosis of cervix, organizing peritoneal hemorrhage, salpingitis isthmica nodosa, papillary cystadenoma of ovary, hematosalpinx, twisted ovarian cyst, diverticulosis of sigmoid colon, adrenal cortical rest in broad ligament	1 each
Pseudomucinous cystadenoma of ovary	1

the cervix cut out of the vagina, removing the entire portio vaginalis. Two traction sutures are placed in the vagina in the midline, one posteriorly including the peritoneal reflection and all layers of the vaginal wall, and one anteriorly, including the perivaginal fascia with the entire vaginal wall. A

TABLE XIV. POSTOPERATIVE HOSPITAL STAY, 518 PATIENTS

Following Vaginal Hysterectomy.—
    Average stay: 15 days
    Range: 9-55 days

Following Abdominal Hysterectomy.—
    Average stay: 12 days
    Range: 7-35 days (except for 88 days for one patient)

TABLE XV. LATE RESULTS, 518 PATIENTS

Following Vaginal Hysterectomy
    Satisfactory results   32
    Vault granulations   4
    Recurrent enterocele and rectocele   1
    Prolapse of vault   1
    Recurrent urinary incontinence   1

Following Abdominal Hysterectomy.—
    Satisfactory results   469
    Vault granulations   129
    Ovarian cyst, possibly due to disturbance of blood supply   4 (known)
    Incisional hernia   3 (known)
    Peritoneal adhesions causing symptoms requiring operation   3 (known)

TABLE XVI. CLIMACTERIC SYMPTOMS FOLLOWING ABDOMINAL HYSTERECTOMY, 483 PATIENTS

AGE GROUP	NO. OF PATIENTS	OVARIES REMOVED	OVARIES NOT REMOVED	NO. PATIENTS WITH CLIMACTERIC SYMPTOMS
To 44 years	265	11		6
			254	10
45-55 years	136	75		12
			61	6
Over 55 years	18	18		1
	12		12	None

gauze sponge with 5 Gm. of sulfanilamide crystals is pushed into the vagina. The lateral angles of the vagina are sutured with figure-of-eight sutures incorporating the cardinal ligaments, as in Fig. 1, then the uterine bundle is tied in. The vagina is narrowed centrally with interrupted sutures. A doubled narrow Vioform-impregnated gauze drain is placed into the vaginal cuff. Peritonization is made with a continuous suture, making no attempt to draw the pedicles of the adnexa into the midline. One end of the drain is allowed to lie under the bladder flap, the other is placed either subvesically or intraperitoneally. Chromic catgut No. 1 or 0 is used throughout.

For vaginal hysterectomy, the cervix is grasped with a volsellum and circumcised. The anterior vaginal wall is divided in the midline and flaps developed over the bladder. The bladder is elevated away from the cervix, and the anterior peritoneal reflection opened. A posterior vaginal flap is elevated, and the posterior peritoneal reflection opened. The cardinal ligaments are clamped with the uterosacrals on each side, cut, and suture-ligated, and the sutures held. The fundus is delivered through the anterior peritoneal aperture, and the adnexa grasped in a bundle on each side, close to the uterus, cut, and suture-ligated. The broad ligaments, and then the uterine vessels,

on each side, are treated similarly and the uterus removed. The peritoneum is closed with a purse-string suture and usually not drained. (Recently we have leaned more often toward drainage in the older age group.) The pedicles of the adnexa and cardinal ligaments are sutured together in the midline as a rule, but occasionally the technique of Heaney[5] is used. The bladder and urethra are elevated by plicating sutures. The vaginal edges are trimmed and approximated with interrupted sutures, closing the vault. The posterior plastic procedure, if any, is then performed. A Foley catheter is placed in the bladder for 4 to 5 days without tidal drainage, and a petrolatum gauze pack is placed in the vagina.
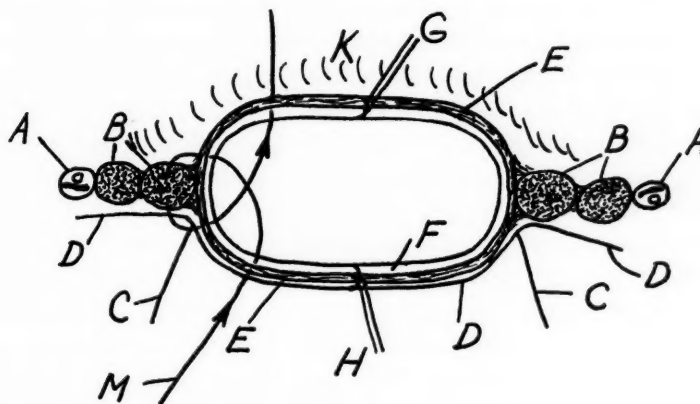
Fig. 1.—Diagram of figure-of-eight suture of vaginal cuff.
A, Ligatured bundle containing uterine artery and vein.
B, Ligatured bundles containing cardinal and uterosacral ligaments.
C, Uterosacral fold in cul-de-sac.
D, Posterior peritoneal reflection.
E, Pericervical and perivaginal (endopelvic) fascia.
F, Vaginal wall.
G, Anterior midline holding suture.
H, Posterior midline holding suture.
K, Reflected urinary bladder.
M, The figure-of-eight suture.

Comment

In the foregoing pages we have presented the details concerning 518 patients submitted to hysterectomy. The results are fairly clear, and show several avenues for study to improve results particularly in reference to reducing morbidity. This has been attempted, and, in the process, a great deal of interesting correlative clinical information has resulted. In the following paragraphs we shall try to answer a number of questions.

What do the common gynecologic symptoms indicate? First, let us consider the symptom of lower abdominal and/or pelvic pain without other symptoms. The commonest pathological findings with this presenting symptom were pelvic inflammatory disease, myomas of the uterus, often with degeneration, peritoneal adhesions, and endometriosis. The remarkable feature among this group of patients was that almost one-third of the group revealed no satisfactory pathological cause for the pain. This emphasizes strongly the need for a careful evaluation of the symptom of pain without associated symptoms. A number of patients in this group were postoperatively discovered to have

intrauterine pregnancies: these will be discussed in a later paragraph. Other causes were appendicitis, internal endometriosis, a twisted ovarian cyst, ovarian cystadenomas, and diverticulitis of the sigmoid colon.

What should menorrhagia without other symptoms suggest regarding diagnosis? In this group, menorrhagia alone was most commonly caused by leiomyomas of the uterus, hypertrophy of the uterus, often with endometrial hyperplasia, and fibrosis of the uterus. Also mentionable as causes are internal endometriosis (adenomyosis), external endometriosis, carcinoma of the endometrium, pelvic inflammatory disease, endometritis, and an ovarian follicular cyst.

What disorder causes abnormal vaginal bleeding associated with pain? This has been found to be most commonly due to myomas of the uterus, hypertrophy of the uterus with relaxation of the pelvic ligaments, and pelvic inflammatory disease. Less frequent causes have been pelvic peritoneal adhesions, external endometriosis, fibrosis of the uterus, carcinoma of the cervix, internal endometriosis, ovarian cysts of the corpus luteum, and endometrial polyp. In some patients no definite cause could be found.

What causes menometrorrhagia? This symptom was most often due to myomas of the uterus, or to adenomyosis. Lesser causes were hypertrophy of the uterus, leiomyomas associated with pelvic inflammatory disease, carcinoma of the endometrium, cervical polyp, corpus luteum cyst, myomas of the uterus with associated endometriosis, and tuberculous endometritis.

What causes simple metrorrhagia? There was no outstanding cause among our 10 cases. Mentionable are leiomyosarcoma of the uterus, fibrosis of the uterus, internal endometriosis, uterine myomas, and endometrial and cervical polyps.

We wish to mention here that the preoperative diagnosis was correct in 80 per cent of instances in this study.

What have been the results of the treatment of carcinoma of the cervix in this series? None of the 8 patients in this group was treated more than five years ago. Three patients died within two years, 2 have been lost to follow-up, and 3 are alive and well 2½ to 4 years postoperatively. The 2 patients lost to follow-up were those with borderline malignancies.

What pertinent features of carcinoma of the endometrium appear in this study? There were 13 patients in this group. Ages ranged from 33 to 79 years. No unsuspected carcinoma of the endometrium was found postoperatively among the 518 patients. Eleven of the carcinomas occurred postmenopausally, 2 before the climacteric. Eleven were manifested by abnormal vaginal bleeding, one by a vaginal discharge, and one was discovered by curettage during a Manchester operation. One instance occurred in a 33-year-old woman, and was treated by radical abdominal hysterectomy with pelvic lymph node dissection. Carcinoma of the endometrium was the etiological factor in 43 per cent of cases of postmenopausal bleeding; however, if vaginal spotting with uterine prolapse is also considered, carcinoma of the endometrium caused 38 per cent of postmenopausal bleeding. Other causes were myomas, endometrial hyperplasia or polyposis, tuberculosis of the endo-

metrium, and carcinoma of the cervix. Vaginal spotting was noted in 8 patients out of 40 with procidentia (20 per cent), and of these, one was due to carcinoma of the endometrium.

What clinical features of leiomyomas of the uterus stand out? There were 196 patients in this group. Ages ranged from 26 to 79 years. The presence of myomas was manifested by menorrhagia, by abnormal vaginal bleeding accompanied by pain, by pain alone especially in cases of degeneration, or by menometrorrhagia. In 28 patients, these tumors were silent, and operation was usually performed for some other reason. Of the myoma group, 85 per cent of patients were parous. Pelvic inflammatory disease or its late results accompanied myomas in 27 patients (14 per cent). External endometriosis accompanied myomas in 16 patients (8 per cent). Leiomyomas of the uterus do not apparently predispose to endometriosis. Internal endometriosis or adenomyosis accompanied myomas in 3 patients. There was one instance of malignant change in a myoma (0.5 per cent); this was manifested by metrorrhagia. There were 3 instances of carneous or red degeneration of myomas, 1.5 per cent.

External endometriosis—what are its clinical features? There were 42 patients in this group. Age incidence was 25 to 51 years, except for one patient, aged 60. Seventy-eight per cent of these patients were parous. Symptoms were pain, menorrhagia, and secondary dysmenorrhea. Menorrhagia was more likely to occur if myomas of the uterus were also present, which association occurred in 16 patients (38 per cent). Therefore, endometriosis is often likely to be associated with myomas, but not the converse. Among 16 patients with myomas and endometriosis, the parity rate was 69 per cent. Pelvic inflammatory disease occurred in 11 of 42 patients with endometriosis, and internal endometriosis in 3. Eight patients with endometriosis were known to have had a previous dilatation and curettage.

What findings are likely to be present with internal endometriosis (adenomyosis)? There were 22 patients in this group, with ages ranging from 29 to 56 years; thus this tends to occur in a somewhat older age group than the external type. Seventy-nine per cent of the patients in this group were parous also, but these patients tended toward grand multiparity, whereas patients with external endometriosis usually had had fewer than three children. Symptoms were menometrorrhagia, menorrhagia, and/or pain. Myomas coexisted in 3 patients.

How often were uterine anomalies encountered? These were noted in 2 patients (0.4 per cent), being in one instance a uterus bicornis unicollis, and in the other instance a uterus bicornis unicollis with rudimentary horn.

Ovarian tumors: Of 214 patients from whom one or both ovaries were removed, 6 were found to harbor ovarian tumors. Two had benign cystic teratomas, one had bilateral pseudomucinous cystadenomas, one had a papillary serous cystadenoma, and 2 had endosalpingiomas, which are classified by some pathologists as papillary serous cystadenomas also.

What pregnancy conditions were encountered? Ten patients whose uteri were removed were pregnant at the time of operation. Three of the preg-

nancies were extrauterine, 7 intrauterine. Two pregnant uteri were removed for the purpose of therapeutic abortion, one for chronic glomerulonephritis, one for rheumatic heart disease. Five pregnant uteri were removed inadvertently: one from a 36-year-old patient with pelvic pain and prolonged menorrhagia, who had myomas of the uterus; the second from a 44-year-old quintipara with menorrhagia of one year's duration; the third from a 36-year-old bipara with pelvic pain and profuse vaginal discharge; the fourth from a 33-year-old quadripara with pelvic pain; and the fifth from a 25-year-old unipara with severe dysmenorrhea who had had dilatation and curettage performed a few months previously. The latter 3 of this group of 5 patients emphasizes again the need for careful evaluation of the symptom of pain without associated signs or symptoms. Careful attention should be paid to the last normal menstrual date, but patients are also occasionally untruthful. Three ectopic pregnancies were encountered; one was an oviducal pregnancy in a 31-year-old nullipara who had a pyosalpinx of the gravid oviduct and a tubovarian abscess in the opposite adnexa; the second was an oviducal pregnancy in a 36-year-old primigravida with residua of pelvic inflammatory disease involving the oviducts. The third was an interstitial pregnancy in a 38-year-old primigravida with multiple myomas and a history of menometrorrhagia.

Was incidental appendicitis encountered? There were 16 patients among the 238 from whom the appendix was removed in this series with pathological evidence of appendicitis. In addition, two appendices contained pinworms (*Oxyuris vermicularis*), and one appendix was involved by tuberculosis of the serosa. The latter appendix was removed from a patient with tuberculosis of the endometrium and salpinges. Fourteen of the appendicitides were chronic in type (6 per cent); a minority of these were accompanied by suggestive symptoms. Two of the appendices were reported to be acutely inflamed. One of these was associated with suggestive symptoms, and was accompanied by residua of pelvic inflammatory disease, for which hysterectomy was done. The other was not associated with suggestive symptoms, and on review of the microscopic slide it was found that there were only a few polymorphonuclear leukocytes in the lumen and mucosa of the appendix, which could hardly be expected to be associated with clinical symptoms. At least one recent study[6] would indicate that acute appendicitis sometimes occurs incidentally to gynecologic laparotomies. Among the 238 appendectomies in this series, we do not feel that there was any instance of incidental acute appendicitis. We would suggest that possibly the routine preoperative enema, abdominal and pelvic examination by one or more examiners within 24 hours preoperatively, or the packing away of the intestines and appendix for varying periods of time during the pelvic operation, with subsequent appendectomy (we remove the appendix before proceeding with hysterectomy in the great majority of instances), may be factors in causing appendiceal irritation and leukocytic infiltration, which should not be classified with clinical appendicitis.

What factors influence the morbidity rate? The morbidity rate for abdominal hysterectomy in this series was 36 per cent. When pregnancy was

present, the rate was 20 per cent; with malignancy present, 27 per cent; with endometriosis, 29 per cent; with myomas, 32 per cent; with adenomyosis, 36 per cent; with pelvic inflammatory disease, 42 per cent; with acute pelvic inflammatory disease, 63 per cent; and when there was no pelvic inflammatory disease, adenomyosis, myoma, endometriosis, or malignancy present, the rate was 43 per cent. Therefore, we feel that it is fair to say that pregnancy, malignancy per se, internal and external endometriosis, and myomas do not tend to elevate the morbidity rate, and that pelvic inflammatory disease, especially when acute, does lead to morbidity.

According to the type of procedure done, the morbidity rate with hysterectomy alone was 35 per cent; when appendectomy accompanies hysterectomy, 41 per cent; and when a vaginal plastic procedure accompanies hysterectomy, 44 per cent. Therefore, it may be said that the more extensive the operative procedure, the more likely is postoperative morbidity. Our series of four subtotal hysterectomies is too small for comment in this regard, but the figures given by Berkeley and Bonney,[7] and by Cron and others[8] show that morbidity is as likely or likelier to develop after subtotal than after total abdominal hysterectomy.

The operating time for abdominal hysterectomies which were followed by morbidity averaged 71 minutes, while the average time for abdominal hysterectomies without morbidity was 68 minutes, a difference which is not suggestive of a relationship between prolonged operating time and postoperative morbidity. The parallel figures for vaginal hysterectomy were 88 and 84 minutes, respectively, again not suggestive.

We must conclude that hysterectomy carries some tendency to morbidity, undoubtedly because of the many tissue planes which must be transected; that careful hemostasis, good operative technique, and minimization of trauma will probably reduce the morbidity rate; and that pelvic inflammatory disease and extensive operative procedures tend to increase morbidity.

Summary

Five hundred eighteen consecutive hysterectomies are presented, of which 93 per cent are abdominal and 7 per cent vaginal. Ninety-nine per cent of the abdominal hysterectomies were total uterine extirpations.

Two patients died postoperatively, both after abdominal hysterectomy; one from concealed hemorrhage from the appendiceal artery, and the other from pulmonary embolism.

The most serious operative complication was transection of a ureter during removal of a large myomatous uterus. This could have been prevented by a preceding myomectomy or morcellation.

Parametritis with or without abscess formation occurring at the vaginal vault was the commonest serious postoperative complication. We have recently been testing various methods of vaginal preparation and vault drainage in an attempt to eliminate this complication: we are not yet ready to state any conclusions. We can say, incidentally, that leaving one end of the vaginal cuff drain in the peritoneal cavity does not cause adhesions, as proved by subse-

quent laparotomy. The remaining postoperative complications should be preventable by proper preparation of the patient, exact surgical technique, early ambulation, and attentive postoperative care.

The morbidity rate was 54 per cent after vaginal hysterectomy, and 36 per cent after abdominal hysterectomy. These rates are high, and we are at present engaged in discovering methods of reducing them.

Chronic cervicitis has been noted to greater or lesser degree in every cervix in this series, except in the presence of acute cervicitis, which usually followed radium application.

Patients remained in the hospital an average of 15 days after vaginal hysterectomy and 12 days after the abdominal. Ordinarily, with uncomplicated recovery, we now discharge patients seven days after the abdominal and ten days after the vaginal operation.

The late results in this series have been satisfactory, except as listed. The most frequently observed pathological lesion was granulation tissue in the vaginal vault, occurring after 27 per cent of abdominal hysterectomies and 10 per cent of the vaginal. Ovarian cysts have occasionally been observed following hysterectomy. These may be due to embarrassment of the ovarian blood supply by the operative technique, as suggested by Freed and Kimbrough,[9] or they may occur spontaneously.

As regards climacteric symptoms, we have not been impressed by an incidence of troublesome symptoms following bilateral oophorectomy in women over age 45. If nervousness, hot flashes, and psychic instability occurred, which they usually did not, control has been generally satisfactory with oral estrogens.

Finally, regarding the abdominal or vaginal route, each has its advantages. Factors in favor of the vaginal approach are:

1. Vaginal plastic procedures can also be done from the single approach.
2. There is less likelihood of intestinal trauma.
3. This approach is on the whole probably less shocking systemically.
4. Evisceration and incisional hernia do not occur.
5. The immediate postoperative intestinal disturbance is less.
6. Postoperative adhesions and bowel obstruction are less likely.
7. There is no residual abdominal scar.

Factors in favor of the abdominal approach are:

1. Morbidity, and thus patient jeopardy, is less likely.
2. Exploration of the abdomen is possible.
3. There is easier access to the adnexa.
4. The appendix can be removed.
5. There is no shortening of the vagina.[10]
6. There is less likelihood of fistula formation.
7. There is less likelihood of vault prolapse.
8. A more exact surgical technique is possible for most operators.
9. Larger tumors are more easily removable by most operators.

10. Better exposure is possible except in the very obese patient.

11. Better hemostasis is usually possible.

12. The postoperative hospital convalescence is shorter.

13. There is less likelihood of urologic complications.

14. The disease process can be better visualized and more accurate evaluation can be made.

15. Peritoneal adhesions to the pelvic organs can be more accurately severed.

16. Prolapse of a portion of the oviduct, or some portion of the bowel does not occur.[11]

The choice of the abdominal or vaginal approach among gynecologists practicing in Schenectady usually depends on the presence or absence of uterine prolapse. We rarely perform vaginal hysterectomy in patients in whom the cervix cannot be pulled down at least to the vestibule without anesthesia.

Conclusions

1. Total hysterectomy is an almost completely safe procedure when adequately performed.

2. If hysterectomy is to be performed, total removal can be accomplished in almost all patients without serious risk.

3. The elimination of most operative complications depends on proper choice of surgical technique.

4. Morbidity is more likely after vaginal than after abdominal hysterectomy; when pelvic inflammatory disease and especially acute pelvic inflammatory disease is present; when appendectomy is performed concurrently; and when the operative procedure in general is extensive.

5. Operating time per se is not significantly related to the morbidity rate.

6. Postoperative parametritis at the vaginal vault, with or without abscess formation, is a common complication after total hysterectomy, and its prophylaxis is not yet completely known.

7. Postoperative complications in general should be preventable by proper preparation of the patient, exact surgical technique, early ambulation, and attentive postoperative care.

8. Some degree of chronic inflammation of the cervix occurs practically universally in women over 25 years of age.

9. The postoperative convalescence is usually shorter after abdominal than after vaginal hysterectomy.

10. Granulation tissue forms frequently in the vaginal vault after total hysterectomy, especially with the abdominal approach.

11. Whether or not the ovaries should be removed with the uterus is a problem which should be individualized, depending on the patient's age, evidence of ovarian function, presence of adnexal pathology, previous operations, the indication for hysterectomy, and the patient's psychosomatic adjustment.

12. Pelvic regional pain without other signs or symptoms may indicate pelvic inflammatory disease, myomas, adhesions, endometriosis, pregnancy, appendicitis, or other disorders. When patients present this symptom, the

pain should be very carefully evaluated, because some of these patients will present no adequate explanation for the pain at operation.

13. Menorrhagia without other symptoms is most commonly caused by myomas of the uterus, hypertrophy of the uterus, and fibrosis of the uterus.

14. Abnormal vaginal bleeding associated with pain is most commonly due to myomas, hypertrophy of the uterus with relaxation of the pelvic ligaments, and pelvic inflammatory disease.

15. Menometrorrhagia is most often due to myomas of the uterus or to internal endometriosis (adenomyosis).

16. Metrorrhagia when occurring alone has no characteristic cause, but must of course be investigated.

17. Carcinoma of the endometrium may occur pre- or postmenopausally, and is not necessarily manifested by vaginal bleeding; in this series, this disorder caused about 40 per cent of instances of postmenopausal bleeding. Other causes are myomas, endometrial hyperplasia or polyposis, tuberculosis of the endometrium, and carcinoma of the cervix.

18. Leiomyomas of the uterus do not predispose to external endometriosis, but endometriosis does predispose to myomas.

19. Menorrhagia is more likely to occur with endometriosis if myomas are also present.

20. Internal endometriosis is found as a rule in patients who have had three or more children, whereas external endometriosis is more likely to occur in patients who have had fewer than three children.

21. Internal endometriosis often causes abnormal vaginal bleeding with or without pain.

22. We do not find that acute appendicitis occurs incidentally to gynecologic laparotomies.

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RADICAL VAGINAL OPERATION (SCHAUTA) FOR CARCINOMA OF THE CERVIX

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IN THE first decades of this century considerable interest existed in the radical vaginal hysterectomy for cancer of the cervix, especially in the Central European clinics. Schauta's name is associated with this procedure which was offered as a substitute for Wertheim's abdominal hysterectomy.[1] The advantages set forth in favor of the radical vaginal operation were: (a) decreased morbidity, (b) decreased mortality, (c) "cure rates" comparable to or even greater than those obtained with the then more formidable abdominal operation. With the advent of radiation therapy for cancer of the cervix, the operative treatment waned considerably in a number of countries, and was in fact regarded as practically obsolete in most centers in the United States, England, France, Scandinavian and other western European countries, as well as in Latin America. Adler[2] continued to support the operation, eventually combining it with local insertion of radium capsules; Navratil[3] in Graz was also a proponent of it for a period since the last World War. Subodh Mitra[4] of Calcutta continues to report series of patients subjected to this operation, contending that in his patients and under his working conditions the lowered operative risk and mortality justify the procedure. Bastiaanse[5] in Holland is also a proponent of the operation. In Italy, Ingiulla[6] has reported his experience with the Amreich modification of the Schauta procedure. Recent communications in the Austrian literature indicate continued employment of the operation.

It is of interest no note that the surgical treatment of cancer of the cervix has been pushed so far into the background in this country that many are not at all acquainted with the operation and most American gynecological texts published in recent years do not even mention the operation.

The outstanding disadvantage of the radical vaginal operation for cancer of the cervix is the failure to reach and excise the pelvic lymph nodes and fatty tissues of the obturator and external iliac regions. Some of the hypogastric nodes and surrounding fatty tissues can be reached. Thus it is admittedly an operation of limited extent. On the other hand, it does not subject the patient to the physiologic strain that obtains with radical panhysterectomy and pelvic lymph node excision and therefore should be accompanied by less morbidity and less mortality.

In the pursuance of a surgical program for attack upon cancer of the cervix in the Memorial Hospital,[7] certain patients were deemed poor operative

risks because of age, obesity, cardiovascular status, asthenia, etc., and for these patients I elected to perform the radical vaginal operation. The limitations of this procedure were fully realized and the failure to excise the lateral pelvic lymph nodes and fatty connective tissues was a calculated risk.

Briefly the operation (patient in lithotomy position) consists of:

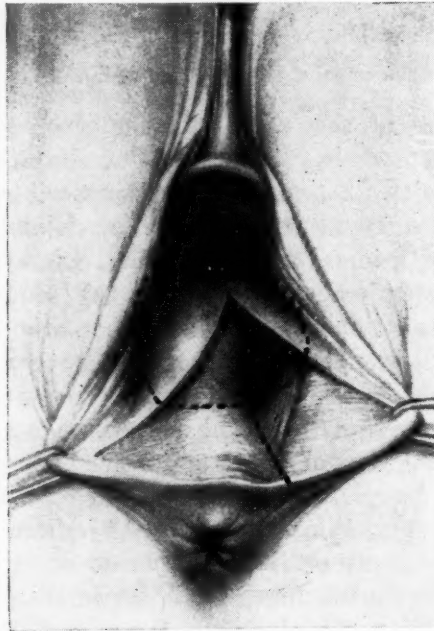1. Schuchardt incision on the left (Fig. 1).

Fig. 1.—Radical vaginal operation (Schauta), showing left Schuchardt incision to widen field of operation and liberate vaginal cuff. (Photograph from Halban.[1]) Dotted line indicates the writer's modification to the short pararectal incision then extended to a circular incision about the vaginal wall to secure a large vaginal cuff constituting the upper four-fifths of the vaginal tract.

2. Starting from the upper portion of this incision a circular incision about the vaginal wall is made, detaching the upper four-fifths from the lower fifth. Dissection is carried upward to separate the bladder from the anterior vaginal wall and the rectum from the posterior vaginal wall.

3. The open end of the upper vaginal tube is then closed horizontally by a continuous suture. The ends of the suture at each extremity of the line are kept long and hemostats applied for traction. In place of the suture a series of four or five Kocher hemostats may be applied to hold the transected vaginal cuff closed.

4. The index finger is pressed upward and laterally from each side of the vaginal cuff and closely hugs the levator ani muscle while pushing the paracervical and parametrial tissues mesially. In this manner these tissues are elevated from the levator ani muscle and freed toward the midline (Fig. 2).

5. By elevation of the vaginal cuff and traction upon it, entrance into the cul-de-sac is made through incision of the peritoneal reflection from

the posterior cervical surface onto the rectum.   The uterosacral ligaments, held taut, are then divided as far back as possible (Fig. 3).

6. Traction on the cuff downward permits further liberation of the bladder base in the midline and the peritoneal reflection from the bladder onto the uterus is divided to the opening into the peritoneal cavity (Fig. 4).

7. Isolation and transection of the main arterial branches to the lateral vaginal walls are next carried out.   Then isolation of the lower segments of the ureters as they enter the bladder wall is carried out. Identification and division of the uterine arteries as they course over and downward from the ureters is the next step.

Fig. 2.—Illustrating the method of digital dissection of the paravaginal and paracervical tissues medially from off the surface of the levator ani muscles after liberation of the vaginal cuff.   (After Halban.[1])

8. The fundus of the uterus is grasped with appropriate forceps and pulled downward in sharply anteflexed position, through the previously made peritoneal opening behind the base of the bladder.   The round ligaments are divided.   Clamps are then applied proximal to the ovaries on their suspensory ligaments and the latter divided and ligated in such a manner as to free the ovaries and tubes which are left attached to uterus. All tissue connections to the uterus and vagina are severed and the latter removed (Fig. 5).

9. The levator ani muscles are approximated over the lower colon by three or more interrupted sutures.

10. I do not attempt to close the peritoneum but insert iodoform gauze packing (which is removed in 24 or 48 hours) into the opening remaining after removal of the vagina and uterus.   A retention catheter is placed in the bladder.

TABLE I. SUMMARY OF 15 PATIENTS SUBJECTED TO RADICAL VAGINAL HYSTERECTOMY FOR CANCER OF THE CERVIX (SCHAUTA TECHNIQUE)

PATIENT AND AGE	CLASS OF LESION* AND INDICATIONS FOR OPERATION	DATE OF OPERATION OPERATING TIME BLOOD INFUSED	PATHOLOGY REPORT	POSTOPERATIVE COMPLICATIONS	HOSPITAL DAYS	RESULT
1. Pal. R. 60 yr.	(L. of N. II) Class PRC Obesity, wt. 226 pounds Preop. radiation B.P. 195/95	4/15/49 1 hr., 20 min. 1,000 c.c.	Epidermoid carcinoma of cervix extending into left parametrium	0	9 days	No complaint to Aug., 1950. Admitted elsewhere. Diagnosis: Arteriosclerotic heart disease. Obstruction right ureter. Died at home Nov., 1951, of "heart attack." Lived 2 yr., 7 mo.
2. Byrd. H. 79 yr.	(L. of N. III) Class C. Age	2/24/49 55 min. 500 c.c.	Epidermoid carcinoma of cervix invading endometrium and both parametria	Disorientation, few days. Bladder atony	20 days	Swollen left thigh due to recurrences, Sept., 1950. Died Dec. 31, 1951. Lived 2 yr., 9 mo.
3. Kim. L. 38 yr.	(L. of N. I) Class A Obesity, wt. 201 pounds	4/7/49 1 hr., 35 min. 1,500 c.c.	Epidermoid carcinoma of cervix, superficially infiltrating. (Not "carcinoma in situ")	0	10 days	Living, well 3 yr., 7 mo. Now 42 yr. old
4. Lat. 74 yr.	(L. of N. I) Class A Age	3/8/49 50 min. 0 c.c.	Epidermoid carcinoma of cervix. Parametria clear	Limited superficial thrombophlebitis of right leg	11 days	Living, well 3 yr., 8 mo. Now 78 yr. old
5. Hol. 80 yr.	(L. of N. IV) Class E Age, recent congestive heart failure	3/10/49 50 min. 500 c.c.	Epidermoid carcinoma cervix; invasion to both parametria and into bladder wall	0	9 days	After discharge to home developed pyelitis and thrombophlebitis, left leg. Died 2½ mo. Recurrence and "heart failure"
6. Fiorel. 51 yr.	(L. of N. I) Class A Obesity, 180 pounds	2/19/49 65 min. 1,000 c.c.	Epidermoid carcinoma of cervix. Parametria, uterus, vagina, clear	0	9 days	Living, well. No recurrences, 3 yr., 9 mo. after operation. Now 55 yr. old
7. Jord. 56 yr.	(L. of N. I) Class PRA Obesity, 230 pounds. Preop. radiation	8/3/48 1 hr., 25 min. 1,000 c.c.	Scattered remnants of epidermoid carcinoma in cervix with permeation of cervical lymphatics. Later had extraperitoneal iliac lymphadenectomy. Nodes, negative	0	8 days	Living, well. No recurrences, 3 yr., 4 mo. after operation. Now 60 yr. old

*The surgical and pathological classification is followed (Am. J. Obst. & Gynec. 64: 413, 1952).

8. DePed. 73 yr.	(L. of N. I) Class PRAo Preop. radiation	10/9/48 1 hr., 30 min. 500 c.c.	Irradiation necrosis and slough of cervix. No residual carcinoma. Mass of Ca on cervix measured 5 by 8 cm.	0	10 days	Living, well 4 yr. after operation. No recurrences. Now 77 yr. old
9. Kanz. 59 yr.	(L. of N. I) Class C Hypertension. B.P. 270/140. Aneurysm of innominate artery	10/14/48 25 min. 0 c.c.	Epidermoid carcinoma of cervical stump with minimal invasion of parametria bilaterally and vagina	0	6 days	Lived without evidence of recurrence for 3 yr., 5 mo. Died of heart failure April, 1952, at age of 62 yr.
10. James, R. 62 yr.	(L. of N. II) Class A Frail subject. B.P. 210/135	10/19/48 35 min. 500 c.c.	Epidermoid carcinoma of cervical stump. Parametria and vagina clear	Acute pyelitis. Bacteremia	33 days	Recurrences manifested in Sept., 1950. Admitted to terminal care home. Condition, Nov., 1952, 4 yr. after operation is terminal. Carcinomatosis. Age 66 yr.
11. Stev. T. 64 yr.	(L. of N. II) Class C Age	11/25/48 55 min. 500 c.c.	Epidermoid carcinoma of cervix invading myometrium, parametrium bilaterally, and onto vagina. Lymphatics permeated	0	11 days	Living, well. No recurrences. Postoperative x-ray therapy. Living and well 4 yr. after operation. Is now 69 yr. old and "working in the country"
12. Coar. 68 yr.	(L. of N. II) Class C B.P. 264/100	12/26/47 1 hr., 10 min. 1,000 c.c.	Epidermoid carcinoma of cervix involving vaginal cuff and myometrium. Metastatic to parametrial node	0	14 days	Very well until early 1951. Readmitted for recurrences in pelvis. Exploratory laparotomy only; biopsy of pelvic recurrences. X-ray therapy; masses completely regressed. Five years after Schauta operation is well. B.P. 240/190
13. Cruz. 39 yr.	(L. of N. I) Class A Obesity. Wt. 190 pounds. Preop. radiation	3/4/48 1 hr., 20 min. 1,000 c.c.	No infiltrating carcinoma observed in cervix. Positive biopsy obtained before preoperative radiation therapy	0	8 days	No evidence of recurrence to Aug., 1951, then patient lost to follow-up
14. Hay. 64 yr.	(L. of N. II) Class A Age. Syphilis	11/18/48 50 min. 1,000 c.c.	Epidermoid carcinoma of cervix. Parametria, ovaries negative	0	11 days	Living, well, no evidence of recurrence 4 yr. after operation. Now 68 yr. old
15. Clem. 50 yr.	(L. of N. I) Class PRAo Obesity, 174 pounds. Short subject. Preop. radiation	9/25/47 1 hr., 40 min. 500 c.c.	Epidermoid carcinoma of cervix on biopsy before preoperative radiation. Surgical specimen showed only radiation necrosis	0	12 days	Living, well 5 yr., 2 mo. after operation. Now 55 yr. old

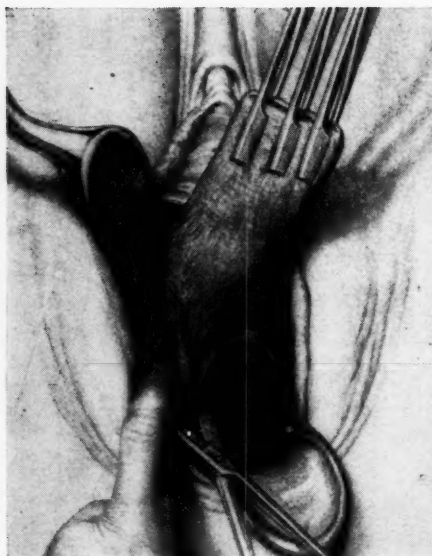Fig. 3.   Fig. 4.

Fig. 3.—Traction upward on the liberated vaginal cuff after incision in the peritoneum of the cul-de-sac results in tension upon the uterosacral ligaments which are then divided. (After Halban.[1])

Fig. 4.—Traction downward upon the vaginal cuff pulls the bladder and terminal portions of the ureters downward. The ureters and uterine arteries are isolated, the arteries divided, and the paracervical ligaments transected as far laterally as possible. The bladder and ureters are freed and permitted to retract upward. (After Halban.[1])

The results in 15 patients operated upon over 3½ years ago are summarized in Table I. (The series is too limited to speak in terms of "percentage results.")

Of these 15 patients:

1 is living and well 5 years, 2 months after operation.
1 is living and well 5 years,* 0 months after operation.
3 are living and well 4 years, 0 months after operation.
1 is living and well 3 years, 9 months after operation.
1 is living and well 3 years, 8 months after operation.
1 is living and well 3 years, 7 months after operation.
1 is living and well 3 years, 4 months after operation.
1 is in terminal condition, due to carcinomatosis, 4 years after operation.
2 died of cardiac failure 3 years, 5 months and 2 years, 7 months respectively after operation. There were no recurrences at the time of death. They had severe cardiovascular disease before operation, and this was the indication for this procedure. The development of cancer was, for them, an intercurrent disease which was adequately controlled.
1 lived 2 years, 9 months, died of recurrences.
1 lived 2½ months, died of cardiac failure, had persistent disease,
1 was observed to be well for 3 years, 5 months after operation but has been lost to follow-up (small lesion in stump; obese subject).

In this small series of patients there was no surgical mortality.

*Four years after operation this patient was re-explored and found to have recurrences in the pelvis. She received pelvic cycles of x-ray therapy, the palpable masses regressed, and she remains well 1 year later. Blood pressure was 240/190 on Dec. 17, 1952, just five years after her Schauta operation.
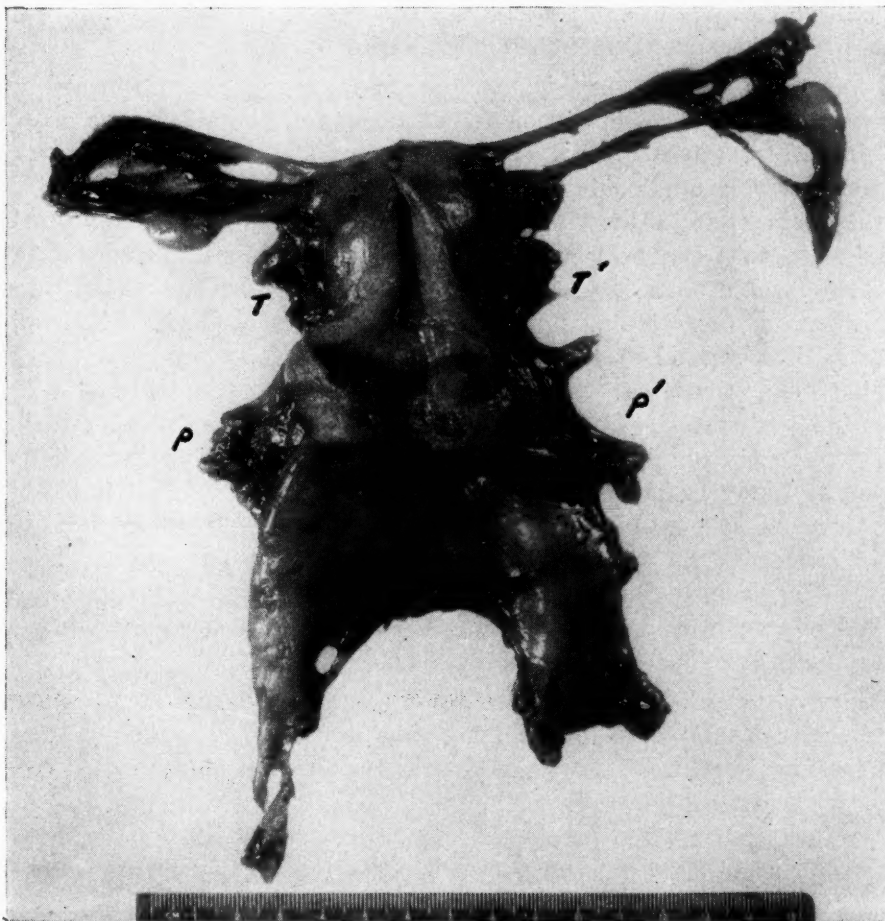
Fig. 5.—Photograph of the surgical specimen consisting of uterus, adnexa, with cancerous cervix and major portion of vagina removed by Schauta radical vaginal hysterectomy. *P* and *P'*, paracervical and vaginal tissues; *T* and *T'*, portions of parametria removed with specimen.

The average operating time was 65 minutes and the average amount of blood transfused was 700 c.c. The average period of hospitalization was 12 days, but the patients were ambulated on the first or second day.

Comment

The radical vaginal procedure, while not difficult for the patient to tolerate, is, from the surgeon's standpoint, not a simple operation. Obviously, a simple vaginal hysterectomy is not adequate for carcinoma of the cervix. As much of the parametria and paravaginal tissues as possible must be removed to accomplish the objectives of the operation.

The question arises of radiation versus the radical vaginal procedure. The latter is carried out in obese individuals in whom pelvic cycles of x-ray therapy would serve little purpose. As to radiation by radium or vaginal cone roentgen therapy, the discomfort in the aggregate is possibly no greater, if as great, with the operation. Moreover, surgical ablation has the advantage

of definitive removal of the growth and there is no question of failure of response to the therapeutic agent (i.e., irradiation).

I am of the opinion, based upon the brief experience summarized above, that the radical vaginal operation for carcinoma of the cervix has a definite place in the treatment of this disease when a surgical program is followed. It is not a widely applicable operation but is to be reserved for selected patients, i.e., obese, and otherwise very poor-risk patients with mobile uteri and small lesions that can be locally and widely encompassed. The inability to ablate the lymph nodes in the region and the connective tissues surrounding them is part of the calculated risk inherent in the procedure. The combination of radical vaginal hysterectomy with extraperitoneal iliac lymphadenectomy has been advocated. This might add to the potentialities of the operation but the advantage of the lymphadenectomy seems more theoretical than practical. In my opinion the subperitoneal lymphatic channels in the pelvis are just as likely to harbor tumor emboli as are the lymph nodes about the large pelvic vessels, and to remove the latter groups of lymph nodes without the pelvic peritoneum would seem to be an incomplete procedure. The situation might be roughly compared to performing a simple mastectomy for cancer followed by enucleation of nodes along the axillary blood vessels without removing the fatty connective tissues in the floor of the axilla.

Because the principal argument for the radical vaginal operation in the past was reduction in morbidity and mortality as compared to the ''Wertheim'' operation and in view of the marked reduction in these factors that modern supportive measures now afford, the question might be raised as to whether there really is justification for the Schauta procedure. As Knaus[8] has recently pointed out, some of those who pursue a predominantly surgical approach to the problem of cancer of the cervix and in the past favored the radical vaginal procedure for its relative safety now tend to perform the abdominal operation more and more frequently because of their improved technique and modern supportive measures that reduce mortality and morbidity. However, as previously stated above, I am of the opinion that the radical vaginal operation does have a definite place in the surgical attack upon cancer of the cervix, but that it is to be employed only in poor-risk patients, especially the obese subjects and those with serious cardiovascular disease who have small lesions. For these patients it can be a safe procedure that can *rapidly* rid them of the cancerous cervix.

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ENDOMETRIOSIS OF THE UMBILICUS

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THE pathological entity known as endometriosis may be defined as the presence of physiologically active uterine mucosa in areas of the body outside the uterine cavity. The first recorded description of the condition is ascribed to von Rokitansky[1] who, in 1860, described an adenomyoma, so it is evident that the existence of endometrial ectopia has been known for many years. Following this, there were only scattered reports until 1895, when von Recklinghausen[2] described the condition and postulated a theory as to its origin. It remained for Sampson,[3] with a series of beautifully reasoned and written studies, beginning in 1921, to call attention to its frequency and importance, and to propose a hypothesis as to its pathogenesis. This served as a stimulus to awaken widespread interest, and resulted in numerous reports on all phases of endometriosis which have since found a place in the gynecological literature. Novak,[4] in his presidential address to the American Gynecological Society in 1948, stated that Sampson's work constituted one of the two most important American contributions to the progress of gynecology in the past quarter century.

Pathogenesis

The pathogenesis of this interesting and important condition has been a subject for continuing and, at times, heated debate since Sampson's original contribution. Briefly, the various theories of origin may be grouped as follows:

1. The embryonal rest theory, first suggested by von Recklinghausen,[5] who stated that cell rests arising from the Wolffian duct system, could, under certain conditions, undergo transformation and development into adult endometrial tissue. Cullen,[6] whose work on adenomyosis constitutes a classic, felt that Müllerian, rather than Wolffian, remnants were the precursors of the ectopic uterine mucosa. However, at best, this theory would explain only the development of endometriosis in areas in or contiguous to the pelvic viscera.

2. The celomic metaplasia theory of Iwanoff,[7] elaborated by Meyer,[8] which has found its strongest supporter in Emil Novak. Since the peritoneum, the ovary, and the Müllerian system have a common origin in the celomic mesothelium, it is felt by those who adhere to this theory that, under some stimulus, possibly hormonal, possibly inflammatory or traumatic, the cells of the peritoneum or of the covering epithelium of the ovary undergo metaplastic change to form endometrial tissue. Meigs[9, 10, 11] has suggested that late marriage, contraception, and spacing of children, with consequent prolonged uninterrupted ebb and flow of estrogenic stimulation, result in the transmutation

161

of unused celomic cells into functioning endometrium. He bases this hypothesis on an increased incidence of endometriosis during the last three decades and on his experience, confirmed by Mallory and others, of a greater incidence of the condition in private as opposed to general hospital patients. This admittedly ingenious theory may be questioned on several points. First, we have no proof that the incidence of endometriosis is actually increasing. As Hobbs and Bortnick[12] point out, there are many examples of the fallacy of the argument that because a lesion has not been found, it does not exist. The revival of interest in the subject of endometriosis with wider recognition by surgeons and gynecologists, more careful study of pathological specimens, greater frequency of and thoroughness in operative procedures involving the peritoneal cavity, all have played a great part in the increasing observation of endometriosis. Sampson's reported incidence of 29.5 per cent was not because more patients with endometriosis came to him for surgery than to other gynecologists, but because his interest led to a more thorough search for typical lesions during operations on the pelvis and abdomen. If it is true that prolonged estrogenic stimulation can cause serosal metaplasia, it may be conjectured that, before long, reports will begin to be seen of endometriosis in males who have undergone prolonged periods of intensive estrogenic therapy because of carcinoma of the prostate. Counseller,[13] on the other hand, states that while there is no question that fully mature areas of endometriosis respond to estrogens, it is by no means established that such a stimulus can initiate the transformation of celomic epithelium into endometrium.

3. The theory which Counseller has aptly termed "the hypothesis of migratory pathogenesis," seems to be the most comprehensive of all. It offers a logical explanation for the appearance of endometrium in all of the widely scattered areas in which it has been reported and there is considerable incontrovertible laboratory and clinical evidence which can be marshaled in its support. Briefly, this theory postulates the dissemination of viable endometrial tissue from the uterine cavity by various routes to new locations, often distant from the pelvis, where it may be implanted and flourish. Cullen[14] explained the genesis of uterine adenomyomas as an invasion of the myometrium, and even contiguous small bowel, abdominal wall, and cul-de-sac by uterine mucosa. Sampson's attractive theory of retrograde menstruation through the Fallopian tube adequately explained the origin of peritoneal endometriosis and stimulated much of the work which has since been carried on. Recent experimental studies by Te Linde and Scott[15] seem to have strengthened beyond reasonable doubt the one potentially weak link in the chain of evidence supporting Sampson's theory —the question of whether the fragments of endometrium cast off during menstruation are actually viable and capable of implantation. By transecting the cervix or upper vagina in rhesus monkeys, and rotating the uterus so that menstruation occurred within the peritoneal cavity, they were able to produce grossly and microscopically typical endometriosis in 50 per cent of their experimental animals. In his discussion of their work, Novak[16] pointed out the possibility that under the irritating stimulus of repeated menstrual discharges,

serosal metaplasia into endometrium might conceivably have taken place, and further studies with this in view are reported to be in progress. Their outcome may serve to establish once and for all, after thirty years, the validity of Sampson's theory.

Endometriosis in such locations as the groin, lymph nodes, lungs, forearm, thigh, and umbilicus may be explained on the basis of lymphatic or vascular transport of endometrial cells or fragments. Sampson[17] first suggested the possibility of lymphatic dissemination in 1922. Gricouroff[18] and Henry[19] have found endometrial tissue in lymph nodes and capillaries, Taussig[20] found endometrial tissue in the iliac nodes of 10 per cent of patients undergoing node resection for carcinoma of the cervix, and, in 1927, Sampson[21] reported his observation of apparently viable endometrium in the uterine sinuses during menstruation. Hobbs and Bortnick, by injecting endometrial clippings into the ear vein of rabbits, were able to produce typical endometriosis in the lungs of 75 per cent of their experimental animals, and were able to demonstrate a decidual reaction in the lesions when pregnancy supervened. They reported on two patients, one with proved endometriosis of the inguinal nodes, who had recurrent hemoptysis at the time of the menstrual flow, and who were relieved of their hemoptysis by radiation castration. In their opinion, both of these patients had pulmonary endometriosis, although neither could be proved by biopsy. Schwarz,[22] in discussing these patients, considered arterial transport to be the only possible mode of origin of the pulmonary lesion.

Endometriosis of Umbilicus

One of the more unusual sites for the development of endometriosis is in the umbilicus. Since Boggs'[23] résumé in 1938, in which he presented chronologically a collection of 97 cases reported to that time, it cannot be considered a truly rare condition, however. Chapman[24] in 1940 added four more cases to Boggs' tabulation. Since that time a survey of the literature reveals seven additional cases, with the following authors each reporting one case: A. G. Pereira,[25] J. Pereira,[26] Novis,[27] Marquardt,[28] de Moraes,[29] de Feo,[30] and Printz, Printz, and Rubin.[31] This comprises a total, with the present case, of 109. However, as Marquardt states, there are unquestionably many more occurrences of this condition, but, because the specimen is not subjected to accurate pathological study, the true nature of the lesion is never ascertained.

TABLE I. RELATIVE FREQUENCY OF ENDOMETRIOSIS OF THE UMBILICUS

AUTHOR	TOTAL CASES	CASES: ENDOMETRIOSIS OF UMBILICUS	INCIDENCE
Counseller[32, 33]	1,638	7	0.42%
Scott and Te Linde[34]	–	–	0.8 %
Fallas and Rosenblum[35]	–	–	0.56%
Jenkinson and Brown[36]	117	3	2.5 %
Pumphrey[37]	48	2	4.0 %

The actual incidence of umbilical endometriosis in comparison with other forms of the disease varies considerably, as may be seen from Table I. Taking the larger series as being more indicative of the frequency with which it

actually occurs, one may assume that the incidence of endometriosis of the umbilicus is from 0.5 to 1 per cent of all endometrial ectopia (Table I).

Etiology

How does the pathogenesis of endometriosis in this location square with the theories previously reviewed? It would seem to be one site where Sampson's implantation theory cannot, in the majority of cases, be brought to bear, although Jacobsen's[38] hypothesis of a minute umbilical hernia into which detached uterine mucosa can migrate has been offered in its support. Were this the case, it would be logical to expect to find some evidence of endometriosis elsewhere in the peritoneal cavity. Unfortunately, the published literature is extremely vague on this point. The majority of reports fail to state whether thorough abdominal exploration was carried out with this possibility in mind. Surgery frequently is confined to simple excision of the umbilicus with no general inspection of the peritoneal cavity. Of the four cases reported by Scott and Te Linde,[34] only one showed endometrial lesion elsewhere. Chapman's[24] case exhibited only umbilical involvement, as was true in the cases published by Roques,[39] de Moraes,[29] and de Feo.[30] Of the two cases reported by Goddard,[40] one patient was explored with negative findings. Weisband and Modica[41] have more recently reported two cases free of lesions save for those of the umbilicus. In the report of Spitz,[42] including 55 cases published up to that time, 10 patients were explored with negative findings, and two patients showed evidence of intraperitoneal endometriosis. Thus the available reports show that of 24 patients explored, only three had exhibited peritoneal endometriosis. This brings one to the conclusion that while implantation may be the mode of spread in a minority of instances, some other explanation must be sought for the majority.

Although Meigs, Weller,[43, 44] Novak, and others feel that serosal metaplasia is the likeliest cause, the possibility of lymphatic transport can by no means be ignored. The finding of apparently viable endometrium within lymph nodes and lymph vessels, the known lymphatic drainage of the pelvic viscera, and the not infrequent occurrence of metastatic lesions of ovarian and uterine carcinoma to the umbilicus lend support to this as a mode of origin. To the objection that nonmalignant tissues do not metastasize, Ewing[45] points out that metastasis can occur in association with thyroid adenoma, chondroma, leiomyoma, and normal chorionic tissue. Speculation on these points has been never ending, and the most tenable conclusion seems to be the assumption of varying pathogenetic mechanisms for the lesion of endometriosis in different bodily situations.

Pathology

Grossly and microscopically the features of umbilical endometriosis are characteristic. In the gross the umbilicus often exhibits one or more tumors of varying size. Adams-Ray[46] states that they may range from the size of a grain of rice to that of an apple. When visible the bluish or cyanotic discoloration which they often exhibit as the result of their content of blood, is

pathognomonic, as is the exudation of bloody or tarry material during the catamenia, or occasionally on pressure. Localized subcutaneous periumbilical fibrosis is often present as a result of the irritating character of the cyst content.

Microscopically, the picture is that of endometrium in any other location. Endometrial glands are seen, lined with columnar epithelium, which may exhibit any of the cyclic variations seen in normally situated uterine mucosa. Characteristic endometrial stroma usually surrounds the gland, but may be scanty as a result of pressure exerted by the dilating gland. If there is pronounced cystic dilatation as a result of repeated menstruation, the epithelium may be flattened to a cuboidal type, or may be so altered as to be nearly unrecognizable. Macrophages with ingested hemosiderin are visible, and hemolyzed blood may be present within the gland lumina.

Diagnosis

The diagnosis presents few difficulties. It is a disease of women in active menstrual life, as are all other types of endometriosis. Patients commonly have the presenting complaint of umbilical pain or tenderness, which may be, and usually is, markedly aggravated during the menstrual flow. The external discharge of blood or blood-tinged fluid may occur concomitant with the menses. The disclosure, on examination, of a tender, indurated umbilicus with the presence of small cystic structures which exudate old blood on pressure, is pathognomonic. Boggs[23] states that any or all of the following symptoms may be present: (1) secretion of blood-tinged fluid; (2) pain around or in the umbilicus; (3) tenderness; (4) swelling; (5) itching; (6) bluish discoloration.

Treatment

Surgery is the treatment of choice. The umbilicus should be excised with a generous margin of uninvolved tissue since microscopic glandular tissue may extend well outside the area in which the process is grossly visible. The defect may be repaired as in the operative treatment of umbilical hernia. If not contraindicated, the incision should be large enough to permit visual or palpatory exploration of the entire peritoneal cavity in order to exclude the possibility of other foci of endometriosis.

Recovery is usually uncomplicated, and recurrence should be unlikely provided all ectopic endometrial tissue has been resected. It is conceivable that, in a patient nearing the termination of her menstrual life, possibly a poor surgical risk, radiation castration might be used with subsequent regression of the umbilical lesion. However, since the risk and discomfort attending such a procedure as resection of the umbilicus are minimal, and since it affords an opportunity for abdominal exploration and the detection and correction of intra-abdominal pathology which may be asymptomatic or unsuspected, surgery seems infinitely more to be preferred than radiation, with the possible consequence of a stormy and protracted climacteric.

Case Report

Mrs. A. B., unit No. 43802, married, white, 32 years of age, was first seen on March 8, 1949, with the presenting complaint of a "sore navel." Questioning elicited the story that for the preceding five months she had noted constant soreness in the umbilical region, aggravated especially at the time of her menstrual period. She volunteered the information that the umbilicus seemed to become swollen shortly before the onset of the menstrual flow, and that she had noted the discharge of small amounts of dark, bloody material from the umbilicus during the menstrual period, following which the swelling and discomfort would subside, leaving only moderate residual tenderness until a few days before the next catamenia. She was very conscious of the relationship between the symptoms referable to the umbilicus and her menstrual cycle, and was somewhat amused at the idea of "menstruating through the navel."

Investigation of her past history revealed no serious illness other than the usual childhood diseases, and no surgical operation. Her menarche occurred at 14, with a quite regular 25 day cycle, the flow lasting five to six days, and quite profuse throughout. There was moderate crampy lower abdominal pain and backache, not incapacitating, during the first two days. There was no history of interval bleeding or discharge. Systemic review was unremarkable save for chronic dyspepsia, belching of gas, and suggestive fatty food sensitivity. She had had one normal pregnancy eleven years before. Since the birth of this child she had had no other pregnancies, though she denied contraception. General physical examination was not remarkable. The umbilicus appeared rather deep, and was quite tender to palpation. In the depths of the umbilicus could be visualized two rounded swellings, each about 2 to 3 mm. in diameter, and one of which exuded a drop of dark bloody material on gentle pressure. Pelvic examination revealed a parous introitus, with well-supported pelvic floor. The cervix was healthy, the uterus in first degree retroversion, of normal size and consistency, and freely movable. There was some tenderness in the region of both uterosacral ligaments, but no induration suggesting endometriosis. Palpation of the adnexal region revealed no abnormality. Presumptive diagnosis: Endometriosis of the umbilicus.

She was admitted to the Fox Memorial Hospital on March 17, 1949, for operation. Urine and blood studies were within normal limits and on March 18, 1949, under gas-oxygen anesthesia, the umbilicus was excised in an elliptical fashion with a good margin of grossly normal tissue and the resulting defect closed in layers with interrupted sutures of No. 40 cotton. Because of the small size of the incision, the pelvis could not be adequately explored. Convalescence was uneventful and she was discharged in good condition on the fourth postoperative day.

Pathological study of the specimen was made by John J. Clemmer, M.D., of the Bender Hygienic Laboratory, Albany, N. Y., as follows: "*Gross:* The specimen consists of an elliptically shaped segment of skin and subcutaneous tissue measuring 5 by 2.5 by 3 cm. and contains within the center of the skin segment a deeply depressed umbilicus. The external surface of the folds of the umbilicus is not remarkable and sections through it show it to consist of dense fibrous tissue. There is no evidence of cystic spaces. *Microscopic:* Serial sections of the umbilicus reveal the presence of a number of small subcutaneous cysts of various sizes which are lined by columnar epithelium, the cells of which have moderately abundant eosinophilic cytoplasm and long, oval, vesicular nuclei. These are surrounded by a collar of small polygonal cells having dark nuclei and scant cytoplasm. *Diagnosis:* Endometriosis of umbilicus." (Fig. 1.)

It was regretted that the small size of the operative incision made thorough search for other foci of endometriosis impossible. However, the patient was readmitted for cholecystectomy in January, 1951, and at operation a generous incision was made. This permitted palpation and fair visualization of the pelvis. The uterus and adnexa showed no gross abnormalities. The

depths of the cul-de-sac were obliterated by dense fibrous adhesions which bound the rectosigmoid firmly to the posterior vagina and uterosacral ligaments. Puckering of the peritoneum typical of old endometrial scarring could be made out and it was felt certain that these changes were due to extensive endometriosis involving the peritoneum of the cul-de-sac.
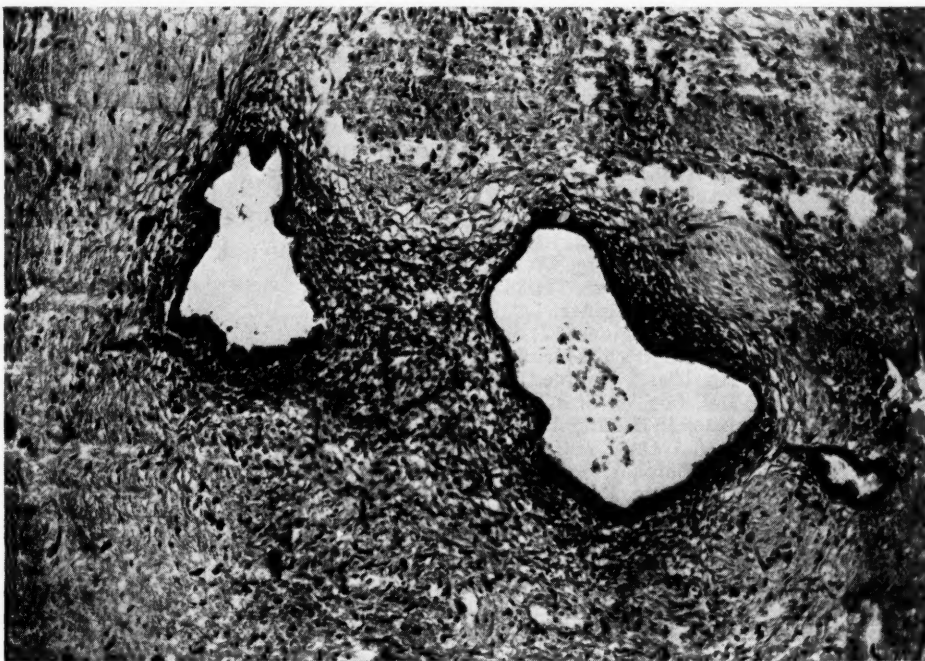

Fig. 1.—In the subcutaneous tissue of the umbilicus is seen a focus of enlarged endometrial glands, surrounded by typical endometrial stroma. (×100.)

Summary and Conclusions

Endometriosis is a common gynecological disease in which ectopic functioning uterine mucosa is found in widely scattered areas of the body. Various theories as to its pathogenesis have been suggested, no one of which can be stated unequivocally to account for endometriosis in all the various locations in which it has been reported. The umbilicus is one of the less common sites for the localization of ectopic endometrium. The incidence in all cases of endometriosis has been reported as from 0.42 to 4 per cent with a total of 108 cases in the literature to date. The evidence that many of these are the result of lymphatic transport of viable endometrium seems convincing. A case of endometriosis of the umbilicus in a 32-year old woman, with extensive endometriosis involving the posterior cul-de-sac, but no other intraperitoneal lesion, is reported.

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THE DIAGNOSIS OF OVARIAN CANCER*

Results of the Study of 210 Patients by the Philadelphia Committee for the Study of Pelvic Cancer

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THE early diagnosis of ovarian cancer is probably one of the most difficult of gynecological problems. The diagnosis rests on the basis of early suspicion, careful evaluation of the symptoms, abdominal, pelvic, and rectal examinations, and sometimes special diagnostic procedures. The general practitioner or the gynecologist is usually the first to see the patient, but in the absence of signs or symptoms that suggest pelvic disease the patient may be seen by specialists in other fields. Patients may present themselves with gastrointestinal, orthopedic, or other symptoms. It is in this period of vague symptoms that early suspicion and prompt diagnosis are of most value. All practitioners must remember the possibility of latent gynecological disease when confronted with puzzling symptoms.

The pessimistic attitude of most doctors concerning ovarian cancer stems from the fact that they have been impressed by the advanced cases, seen too late to be cured. This defeatist attitude can be overcome only by a greater alertness to the possibility of its presence, and, with that thought in mind, by a thorough examination of patients.

The material for this paper was derived from the records of the Philadelphia Committee for the Study of Pelvic Cancer. A five-year study by this committee for the years 1945 through 1949 showed that 210, or 9.5 per cent, of the 2,219 cases of pelvic cancer were ovarian.

Age Incidence.—

Of the 210 patients studied, 18.5 per cent were between the ages of 11 and 40 years, 60.6 per cent were between the ages of 40 and 60, and 20.9 per cent were over 60 years of age. Comparison of the figures of the age incidence of carcinoma of the ovary (Table I) with those of the female population in the United States for the year 1940 (Table II) shows a gradual increase in occurrence of ovarian carcinoma with increase in age, particularly between the ages of 40 and 60 years (Fig. 1).

According to the Bureau of Vital Statistics of the Department of Public Health of the City of Philadelphia, 9.4 per cent of the ovarian cancer deaths occurred in Negroes. In our studies this figure was 25 per cent (Table III).

Menopause.—

One hundred twenty-one, or 59 per cent, of the 210 patients studied were postmenopausal, and 84, or 41 per cent, were premenopausal. In 5 patients

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the menstrual status was not noted. Age distribution, according to decades, at the time the menopause occurred is shown in Table IV, *A* and *B*. In 53 patients, or 50.5 per cent of those studied, the natural menopause occurred after the age of 50. The average age of natural menopause in the ovarian cancer patients was 49 years and 5 months. The average age of menopause in the control group was 47 years and 5 months. The menopause was surgically induced in 16 women. In 9 of these a hysterectomy was performed at the age of 45 or over. These facts stimulate interesting speculation. At this age, the risk of ovarian cancer may be of greater significance than the inconvenience of an artificial menopause. Therefore, if a hysterectomy is to be performed at this age, there seems to be a sound indication for performing in addition a bilateral salpingo-oophorectomy if the ovaries show any evidence of disease. This may well serve as a practical preventive measure for reducing the incidence of ovarian carcinoma.
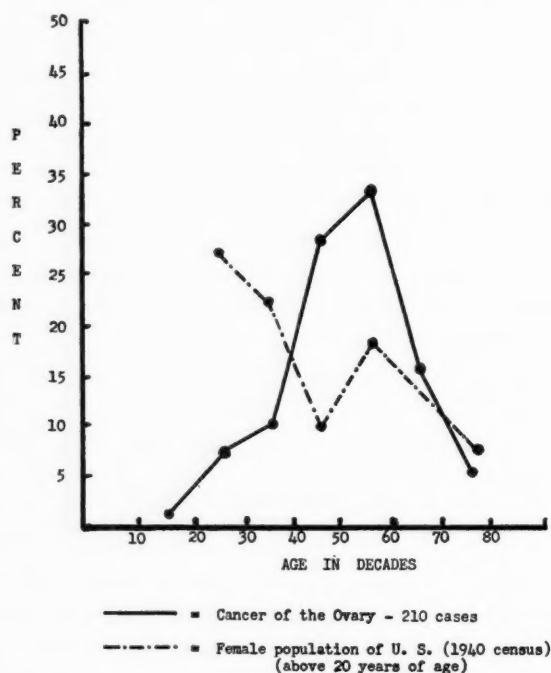

Fig. 1.

Fertility.—

In this group of 210 patients, 176, or 84 per cent, were married, widowed, or divorced; 32 patients, or 15 per cent, were single, and 2 of the patients were children aged 11 and 13 years, respectively. The parity of 196 women was noted but the figures for the number of pregnancies and abortions were not complete. Table V shows a comparison of the parity of these 196 women by age decades, and of a similar number of office patients and of gynecologic patients in a Philadelphia hospital. It is interesting to note that 60.6 per cent of the Pelvic Cancer Committee patients were para 0 or para i, as compared

with 37.3 per cent of office gynecological patients and 36.9 per cent of gynecological hospital patients. These figures substantiate statistics compiled by other workers who have found that women who develop ovarian cancer are less fertile. The incidence of para 0 and para i is much higher in our group of ovarian cancer patients than in either of the control groups.

TABLE I. AGE INCIDENCE IN 210 CASES OF OVARIAN CARCINOMA

AGE GROUP (YEARS)	NUMBER OF CASES	PERCENTAGE OF TOTAL
10-19	3	1.4
20-29	15	7.1
30-39	21	10.0
40-49	58	27.7
50-59	69	32.9
60-69	33	15.7
70-79	11	5.2
Total	210	100.0

TABLE II. FEMALE POPULATION OF UNITED STATES (1940) (OVER 20 YEARS OF AGE)

AGE GROUP (YEARS)	NUMBER	APPROXIMATE PERCENTAGE
20-29	11,541,419	27.0
30-39	9,971,794	22.0
40-44	4,368,708	10.0
45-54	7,550,052	18.0
55-64	5,163,025	13.0
65-74	3,209,134	8.0
75-	1,404,606	2.0
		100.0

TABLE III. RACE INCIDENCE IN PELVIC CANCER DEATHS IN PHILADELPHIA (1949)

	PELVIC CANCER DEATHS		OVARIAN CANCER DEATHS		OVARIAN CANCER CASES (PELVIC CANCER COMMITTEE)	
	NO. OF CASES	%	NO. OF CASES	%	NO. OF CASES	%
White	331	81.5	87	90.6	157	75.0
Negro	75	18.5	9	9.4	53	25.0
Total	406	100.0	96	100.0	210	100.0

TABLE IV. AGE DISTRIBUTION OF INCIDENCE OF MENOPAUSE

AGE GROUP	NUMBER OF PATIENTS	PERCENTAGE
A. Menopause.—		
20-29	4	3.3
30-39	8	6.6
40-49	55	45.5
50-59	53	43.8
60-69	1	.8
Total	121	100.0
B. Natural Menopause.—		
20-29	2	2.0
30-39	5	4.7
40-49	45	42.8
50-59	52	49.5
60-69	1	1.0
Total	105	100.0

TABLE V. INCIDENCE OF PARITY

SOURCE OF PATIENTS	PARA 0		PARA i		PARA ii AND OVER	
	NO.	%	NO.	%	NO.	%
Pelvic Cancer Committee (ovarian cancer)	62	31.6	47	29.0	87	39.4
Office practice (gynecologic)	38	19.4	35	17.9	123	62.7
Hospital patients (gynecologic)	37	19.0	35	17.9	124	63.1

Symptoms.—

The most frequent complaints of the patients with ovarian carcinoma are shown in Table VI. They are abdominal pain, abnormal uterine bleeding, gastrointestinal symptoms, and progressive enlargement of the abdomen. They may appear singly, or in any combination.

TABLE VI. INCIDENCE OF PRESENTING SYMPTOMS

SYMPTOM	NUMBER OF CASES	PERCENTAGE
Abdominal pain	49	23.3
Abnormal uterine bleeding	46	21.9
Premenopausal:		
Menorrhagia	8	
Metrorrhagia	8	
Irregular	2	
Postmenopausal	28	
Gastrointestinal	20	9.5
Abdominal enlargement	74	35.2
Other complaints	21	10.1
Total	210	100.0

Abdominal pain was present in 41.4 per cent of the patients studied. It was the presenting symptom in 23.3 per cent of the patients. Most of them experienced the pain in the lower abdomen. Occasionally it was located in the periumbilical or upper abdominal areas.

Abnormal uterine bleeding was present in 69 patients, or 32.8 per cent of those studied by the Philadelphia Pelvic Cancer Committee. It was the presenting symptom in 46 patients, or 21.9 per cent. Of these, 8.6 per cent were premenopausal, and 13.3 per cent were postmenopausal. In 20 patients a brownish or bloody discharge occurred.

Gastrointestinal symptoms (exclusive of abdominal pain), such as loss of appetite, dyspepsia, nausea and vomiting, or rectal pain, were present in 38 patients, or 18.1 per cent of the total studied. They were the presenting symptoms in 20 patients, or 9.5 per cent of the total group.

Rapid increase in the size of the abdomen was the most common symptom of ovarian carcinoma, being present in 110 patients, or 52.4 per cent of the total studied. It was the presenting symptom in 74 patients, or 35.2 per cent. It may be due to increasing ascites, increase in the size of the tumor, or both.

Amenorrhea was present in 3 women, one of whom had an intrauterine pregnancy associated with bilateral ovarian carcinoma. The remaining 18 patients presented with various complaints suggesting urologic, orthopedic, or other disease.

It is evident from our discussion of the symptoms that they present no characteristic pattern which would suggest the diagnosis of ovarian carcinoma. The anatomical structure and location of the ovary allow it to enlarge considerably before it gives evidence of its presence, unless torsion of the pedicle occurs or it becomes adherent to adjacent structures. Occasionally rupture of a malignant cyst will occur early and produce pain. Chiefly, the value of these symptoms depends on the determination of their origin. Then again, by their very vagueness they should alert us to the possibility of ovarian carcinoma.

Comment

As a result of our personal analysis and the discussion of cases at the Philadelphia Pelvic Cancer Committee meetings, we feel that the comments which follow are significant.

Every abdominal examination should include a search for free fluid in the peritoneal cavity since ascites may be the first sign of ovarian malignancy. Ascites due to medical conditions such as cardiovascular and renal disease, tuberculous peritonitis, hepatic cirrhosis or liver-spleen disease must be excluded by appropriate physical and laboratory examinations.

In the presence of a tense, distended abdomen there may be difficulty in differentiating ascites from a large ovarian cyst. With moderate fluid distention, shifting dullness can usually be elicited and will establish the diagnosis of free fluid. If necessary for accurate diagnosis, it is wiser to evacuate the fluid through a small incision under local anesthesia, rather than by the use of a trocar which occasionally punctures a malignant ovarian cyst and thereby spreads the disease throughout the abdominal cavity. The same result may be produced by peritoneoscopy. Premature death has resulted from the puncture of a malignant ovarian cyst. Following paracentesis the abdominal, pelvic, and rectal examinations of the patient will be greatly facilitated.

The importance of a careful rectal examination in virginal women in whom pelvic disease is suspected cannot be overemphasized. One of the patients in this group was 11 years old and another was 13 years old. If a rectal examination had been performed at the time of onset of their symptoms, their disease might have been detected earlier and their prognosis improved by earlier surgery.

Cytologic examination of the ascitic fluid should always be done. Although paracentesis was performed many times upon our patients, malignant cells were reported only four times in the ascitic fluid.

The presence of a hard and sometimes tender tumor mass resembling a uterine fibroid, but more often associated with abdominal pain and gastrointestinal symptoms, should suggest the possibility of ovarian carcinoma regardless of the presence of uterine bleeding. This is especially true if the patient is a virgin. Under these circumstances, the diagnosis of uterine fibroids will seem obvious and the possibility of ovarian cancer will not be remembered; surgery will be deferred and vital time will be lost.

Uterine fibroids were found in association with ovarian carcinoma in 6 patients. Obviously their presence will make the diagnosis even more difficult.

When examination reveals the presence of a frozen pelvis, associated with ovarian tumors or nodules in the cul-de-sac, the examiner should naturally suspect ovarian carcinoma. It is desirable to attempt to outline the uterus and determine its mobility, but under such circumstances this may be extremely difficult. Of the 210 cases in our series, 50 were inoperable, indicating the frequent association of ovarian cancer with a frozen pelvis.

In the evaluation of small ovarian enlargements special attention should be paid to mobility and hardness, which are more important than size. Limitation of mobility and firmness in an ovarian tumor suggest malignancy. Any ovarian cyst that increases or remains constant in size should be removed, particularly in a woman past 40 years of age. Other enlarged ovaries should be examined frequently and regularly for changes in size, consistency, and mobility. Any significant persistent change may well be an indication for oophorectomy.

It is important to remember that benign fibromas of the ovary may be associated with ascites and hydrothorax, the so-called Meigs syndrome. The ovary may be the site of secondary metastases from malignant lesions of the breasts, stomach, or intestinal tract, some of which may be Krukenberg tumors. One patient, aged 74, was found to have a Krukenberg tumor which developed three years after the appearance of adenocarcinoma of the stomach. Another patient, aged 20, was found to have a pelvic mass and in addition an upper abdominal mass due to carcinoma of the stomach. These conditions emphasize the importance of the general examination of the patient, as well as the pelvic and rectal.

In patients complaining of abdominal pain and gastrointestinal symptoms, special examinations will be necessary to rule out disease in the gastrointestinal tract, especially if a mass is felt in the lower left quadrant of the abdomen. Barium enema, sigmoidoscopy, stool examination, and x-ray examination of the upper gastrointestinal tract may be required. The most common causes for tumors in the lower left colon are malignancy of the sigmoid and diverticulitis. Since many of these patients are first seen by the internist or gastroenterologist, he should remember that gastrointestinal symptoms may arise from an ovarian carcinoma.

In younger women pelvic inflammatory disease or endometriosis may have to be differentiated from ovarian carcinoma. These errors in diagnosis occurred in this series of patients. In doubtful cases an exploratory laparotomy should be done. Exploratory laparotomy as a diagnostic examination deserves more consideration and credit than it is usually given. We feel that it is preferable to peritoneoscopy in most cases.

There was nothing distinctive about pre- or postmenopausal bleeding in relation to the diagnosis of ovarian malignancy in these patients. In the presence of postmenopausal bleeding, when the curettement shows no endo-

metrial tissue, or an atrophic endometrium, the possibility of Fallopian tube or ovarian carcinoma should be strongly suspected, provided of course that cervical carcinoma has been excluded by biopsy.

Malignant granulosa-cell tumors were found in 9 patients. The signs and symptoms of these tumors are similar to those of other ovarian carcinomas, although the tendency for abnormal uterine bleeding is greater. Four of 9 patients showed this symptom. Two were premenopausal and two were postmenopausal. Hyperplasia of the endometrium is a common finding in granulosa-cell tumors. A bleeding postmenopausal patient, who, on examination, shows hyperplasia of the endometrium and a palpably enlarged ovary, should be suspected of having a granulosa-cell tumor of the ovary. It must be remembered that endometrial hyperplasia may be associated with or be the precursor of endometrial carcinoma.

There were 2 patients with amenorrhea in the absence of pregnancy who had ovarian carcinoma. A pregnancy test done on one of these was positive. Zondek reported a characteristic pregnancy response by the injection of urine in 15 per cent of 118 cases of genital malignancies.

The importance of making an accurate diagnosis of ovarian carcinoma at the time of operation has not been properly emphasized. With the co-operation of the pathologist and the use of frozen sections, the surgeon would know more accurately how extensive his extirpation of the lesion should be. If this procedure were followed it would avoid the necessity for reoperation of patients in whom a postoperative diagnosis of a malignant tumor is obtained. In this series there were 51 such patients.

When a vaginal hysterectomy is performed the surgeon is less likely to examine the ovaries because of the technical difficulties involved. In this series of patients there was one in whom an ovarian carcinoma was found two years after a vaginal hysterectomy. This indicates the importance of examining the ovaries for evidence of disease at the time of a vaginal hysterectomy.

Factors of Delay in Diagnosis.—

Probably the most serious factors hindering the early diagnosis of ovarian carcinoma are failure of the patient to present herself for periodic examination or immediately after the onset of symptoms, and failure of the physician thoroughly to examine the patient who comes to him; sometimes both of these factors are involved. These factors are analyzed in Tables VII and VIII.

Patient delay occurred in 73 patients, or 34.8 per cent; many reasons were given. Some thought their symptoms were unimportant. Many hesitated because it would increase financial burdens and interfere with their family responsibilities. Fear and modesty were the reasons in a few. Some patients refused to be hospitalized in spite of the advice of the family physician and gynecologist. When carcinoma is suspected it is the duty of both practitioners to insist on hospitalization, by influencing the patient or other members of her immediate family.

TABLE VII. ANALYSIS OF PRESENTING SYMPTOMS IN RELATION TO DELAY OF DIAGNOSIS

SYMPTOMS	NO. OF CASES	NO. DELAY	PATIENT AND PHYSICIAN DELAY	PATIENT DELAY	PHYSICIAN DELAY
Abdominal pain	49	20	2	15	12
Abnormal uterine bleeding					
Premenopausal:					
Menorrhagia	8	2	3	3	0
Metrorrhagia	8	3	2	3	0
Irregular	2	0	0	1	1
Postmenopausal	28	9	3	12	4
Gastrointestinal	20	9	2	8	1
Abdominal enlargement	74	28	8	25	13
Other complaints	21				
Total	210				

TABLE VIII. A, EXAMINATION, AND B, DELAY

	CASES	PERCENTAGE
A, Pelvic Examination.—		
Complete pelvic	81	38.6
No speculum examination	50	23.8
None	79	37.6
Total	210	100.0
B, Delay Period.—		
No delay	75	35.7
Physician and patient	26	12.4
Patient	73	34.8
Physician	36	17.1
Total	210	100.0

Physician delay occurred in 36, or 17.1 per cent, of the patients studied by the Philadelphia Committee for the Study of Pelvic Cancer. Delay involving both the physician and patient occurred in 26 patients, or 12.4 per cent. Physician delay resulted, first, from failure to make the essential pelvic, rectal, and speculum examinations of the patient as part of a complete general examination. Second, it resulted from failure to account adequately for the patient's symptoms, especially when they were gastrointestinal or otherwise nongynecologic in nature. Many of these patients received "electrical" or injection treatments, especially those who were not properly examined. As a result, valuable time was lost.

The same factors of physician-patient delay operate in those instances of patients attending hospital clinics. Failure to make proper examinations or to account adequately for symptoms is likely to occur, especially among those patients who are regarded as neurotics. Institutional delay occurred in 7 patients. This could be avoided if every patient whose complaints have not been satisfactorily accounted for were examined and studied by an experienced gynecologist.

Periodic Pelvic Examination.—

There were 75 patients in whom there was no delay period. These patients presented themselves immediately after the onset of symptoms. Nevertheless 41 of these cases were found to be inoperable, a most significant

finding, since it demonstrates that ovarian carcinoma can be insidiously silent. The inevitable conclusion is that these cancers could have been discovered early only by routine periodic pelvic examinations. It seems unlikely that all these patients could have been completely asymptomatic. Proper questioning would undoubtedly have revealed symptoms either ignored or forgotten in many instances.

Pathologic Diagnosis.—

Pathologic examinations were done in thirty-three different laboratories. It is not our intention to discuss this subject but analysis revealed a confusing variety of diagnoses. There is obviously a great need for a uniform nomenclature for the pathologic diagnosis of ovarian tumors. This objective has the support of the Ovarian Tumor Registry of the American Gynecological Society.

Summary

1. Two hundred ten cases of ovarian carcinoma taken from the records of the Philadelphia Committee for the Study of Pelvic Cancer have been reviewed.

2. The greater incidence of ovarian carcinoma in women who were nulliparous or only para i seems significant.

3. The symptoms complained of showed no characteristic pattern. The importance of determining the cause of genital bleeding is emphasized.

4. The aid of the pathologist and the use of frozen sections are suggested.

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A COMPARISON OF THE INFLUENCE OF ALPHA-ESTRADIOL DIPROPIONATE AND OF ESTRADIOL CYCLOPENTYLPROPIONATE ON THE VAGINAL MUCOSA OF NONMENSTRUATING AND IRREGULARLY MENSTRUATING WOMEN

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THE purpose of the present investigation was to observe the effects of a single injection of each of two estrogenic preparations and to compare one preparation with the other. Determination of the effectiveness of each of the preparations was based, objectively, upon certain measurable alterations occurring in the vaginal smears and, subjectively, upon changes in the clinical picture reported by those subjects experiencing symptoms of the climacterium.

Methods and Materials

Twenty-seven women, ranging from 36 to 71 years of age, selected from the Endocrine Clinic of Metropolitan Hospital, served as subjects for the study. Of these, 12 women were postmenopausal, 6 were surgically castrated, 6 were menopausal, and 3 were menstruating irregularly. The group designated as "menopausal" included those women whose menses had ceased within the preceding three years and that termed "postmenopausal," all subjects beyond the menopausal period.

In those instances in which an individual received a single injection of each preparation, an interval of from three to seven weeks was allowed to elapse between the two to avoid a vaginal "priming" effect of the first upon the second. The preparations employed were an alpha-estradiol dipropionate and estradiol cyclopentylpropionate, each administered intramuscularly in doses of 5 mg.

Vaginal smears were taken daily whenever possible by the patients for an average period of from two to three weeks prior to the administration of the estrogenic material. From a study of such control smears, each patient was classified as to smear type according to the criteria of Papanicolaou and Schorr[1] (Table I). Subsequent alterations in the vaginal smears under the influence of the injected hormones were evaluated in accordance with those initial observations. Details related to the taking of smears, staining methods, and daily tabulation of observations have been previously described.[2]

Results

Sixteen subjects received both preparations in a series of seventeen trials with the alpha-estradiol dipropionate and of twenty trials with the estradiol cyclopentylpropionate. Of these 16 subjects in whom the preparations were alternately administered, 8 first received the alpha preparation and 8 received the cyclopentylpropionate preparation initially. Ten patients received the estradiol cyclopentylpropionate alone and to 1 patient the alpha-estradiol dipropionate only was administered.

Of the 48 injections administered, 28 were followed by a follicular response in the vaginal epithelium which was reasonably believed to be due to the injected hormone. In 4 trials, the results were questionable because of cyclic ovarian activity which had been observed in the vaginal smears taken during the control period. There were 7 instances in which the vaginal smears were not appreciably altered from those obtained in the control period. Poor technique in taking the smears made it necessary to discard nine "runs" in the series.

TABLE I. SUMMARY OF THE COMPARATIVE ACTION OF ALPHA-ESTRADIOL DIPROPIONATE AND ESTRADIOL CYCLOPENTYLPROPIONATE ON THE VAGINAL SMEARS OF WOMEN

TEST		NO. OF SUBJECTS	ALPHA-ESTRADIOL DIPROPIONATE		ESTRADIOL CYCLOPENTYLPROPIONATE	
			RANGE	AVERAGE	RANGE	AVERAGE
Lag-time		14	1-13	3.8		
(days)		21			2- 8	3.6
Peak of response		15	2-13	6.1		
(days after injection)		24			2-12	6.5
Duration of response	A*	4	10-22	18.5		
(days)		10			7-29	16.8
	B	10	10-25	17.0		
		14			10-29	18.5
Degree of response with	1+	11				
relation to duration		9				
of response (in days)	2+	3		17.4		18.6
		9				
	3+	2†				
	4+	2†				

*Response A: May be of longer duration than the figure given but several subsequent slides are poorly taken, stain poorly, or had not been returned to the clinic.

†Cornification of 3 and 4 plus degrees (50-75 per cent and 75-100 per cent) appeared in the slides of patients whose control smears showed evidence of cyclic ovarian activity and the duration of response in these instances is not included in the table.

1. *Lag-Time.*—In all smears the ratio of cornified to noncornified epithelial cells is used as an index of response. The subject is considered not to respond until vaginal cornification reaches 10 per cent and, from this level of response, the smears have been graded from 1 plus to 4 plus (see legend appended to Table I). In accordance with these criteria, the lag-time varied from one to seven days (average 3.7 days). For each preparation, alterations of less than 10 per cent appeared in the smears in from one to six days but errors inherent in our method of procedure do not justify the use of such changes as satisfactory criteria of drug effect and, therefore, such data have been summarily disregarded.

The time elapsed between the administration of the estrogenic material and the appearance of a significant change in the vaginal epithelium indicative of a follicular response was essentially the same for the two preparations used. Although the series is small, the slightly longer averaged lag-time observed following the injection of estradiol cyclopentylpropionate is not statistically appreciable.

2. *Duration of Estrogenic Effect.*—The duration of the estrogenic response varied from ten to twenty-six days. It was longer when estradiol cyclopentylpropionate was administered initially than when the alternate preparation was given first. Individual variations were marked, however, and in so small a series sweeping conclusions regarding the relative duration of action are unwarranted.

3. *Degree of Vaginal Response.*—When estradiol cyclopentylpropionate has been administered, and without regard to the order of administration, the de-

gree of follicular response appears to be greater than following the administration of the alpha-estradiol dipropionate. In a majority of the subjects the degree of stimulation can be correlated with the duration of the response (Table I).

4. *Symptomatic Relief.*—Alterations in the vaginal smears were not quantitatively related to the symptomatic relief observed. Improvement in regard to symptoms, such as flushes and night sweats, was reported in all instances. *Complete* freedom from symptoms was obtained in 4 patients who received both preparations, in 1 patient who received only the estradiol cyclopentylpropionate, and in 1 patient who was given the alpha-estradiol dipropionate alone. One subject, who had experienced only partial relief in each of two trials with the estradiol cyclopentylpropionate, reported complete remission of symptoms following a single injection of the alpha preparation but symptoms reappeared two weeks later, whereas improvement after each of two single doses of the alternate preparation had been maintained for four and five weeks, respectively.

The duration of clinical improvement ranged from one to eight weeks or an average of four weeks following the administration of alpha-estradiol dipropionate and of almost five weeks when estradiol cyclopentylpropionate had been given. We believe relief was obtained for an even longer period in some of the patients who did not return to the clinic on schedule but who at a later date again sought relief of symptoms. In this regard, while it has been difficult to compare the two preparations with finality, one gains the distinct impression that the estradiol cyclopentylpropionate exerted a clinically useful action for a longer period of time. Despite relatively long intervals of ''control'' between injections, ''priming effects'' may have occasionally influenced the observations.

Summary

1. Twenty-seven women were treated with single injections of equivalent amounts of two estrogenic preparations to a total of 48 tests. In 32 tests changes occurred in the vaginal mucosa. No objective response followed 7 of the remaining 16 injections and 9 results had to be discarded.

2. Alpha-estradiol dipropionate in sesame oil and estradiol cyclopentylpropionate in sesame oil were the estrogens employed in these tests. Each preparation was given in doses of 5 mg. by the intramuscular route.

3. Daily vaginal smears were taken for a control period of one week or longer prior to therapy and were taken daily or every other day for an average period of not less than three weeks thereafter.

4. The lag-time (days between the injection and the vaginal response) for each preparation ranged from one to seven days with an average of 3.7 days.

5. The average duration in days of the vaginal response initiated by the injections of hormone was 17.8 days.

6. The degree of follicular activity was greater following the administration of estradiol cyclopentylpropionate than after the use of alpha-estradiol dipropionate.

7. The duration of the vaginal changes was correlated with the degree of follicular stimulation observed rather than with the preparation employed.

8. Climacteric patients reported symptomatic relief starting in from one to five days following the administration of either estrogen and persisting for from one to eight weeks thereafter. Symptomatic relief lasted longer following the injection of the estradiol cyclopentylpropionate than it did after the administration of alpha-estradiol dipropionate.

Comment and Conclusion

One gains the impression that, at the same dosage level, alpha-estradiol dipropionate and estradiol cyclopentylpropionate require approximately the

same amount of time to produce a measurable effect on the vaginal smear. The degree of response appears to be greater with the estradiol cyclopentylpropionate preparation than with the alpha-estradiol dipropionate according to observations on the vaginal smears, whereas the duration of response can be correlated with the degree of stimulation and is approximately the same for each preparation.

The symptomatic relief obtained with the administration of estradiol cyclopentylpropionate was not greater in degree but of longer duration than that experienced with alpha-estradiol dipropionate.

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PROLAPSE OF THE UMBILICAL CORD

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DURING the past five years (1947 to 1951), at the Charity Hospital of Louisiana, there were 52,473 deliveries. Of this number, there were 105 cases in which the delivery was complicated by prolapse of the umbilical cord. This number represents an incidence of 0.2 per cent, or one in each 499 deliveries. Premature deliveries are included in this series, as well as those cases admitted as emergencies, in which the prolapse of the umbilical cord occurred prior to admission. Statistical analysis will show how various factors affect fetal mortality.

The total fetal mortality in this series was 49.0 per cent; four neonatal deaths were included because death was directly attributable to the complicating prolapsed cord. The most influential factors affecting fetal mortality were the condition of the cervix, presentation of the fetus, and the maturity of the fetus. Accurate history of the condition or the duration of rupture of the amniotic sac was, in most instances, unobtainable or unreliable and, consequently, not used in this review.

No unusual disparity was noted in the gravidity as a predisposing factor. Twenty primigravidas and 85 multigravidas comprised the group that was studied.

The greatest single contributing factor in predicting fetal mortality was the condition of the cervix. In over-all analysis, the incompletely dilated cervix resulted in a fetal mortality of 72.0 per cent.

TABLE I. CONDITION OF THE CERVIX AND FETAL MORTALITY

CONDITION OF CERVIX	NO. OF CASES	INCIDENCE	FETAL DEATHS	MORTALITY RATE
Complete dilatation	51	49%	13	25%
Incomplete dilatation	54	51%	39	72%

The premature fetus, always an unfortunate victim when complications in delivery arise, experienced the usual fate when prolapse of the umbilical cord occurred. The premature delivery was the second greatest contributing factor in predicting fetal mortality. In this series, all infants in the 1,000 to 2,500 gram weight group were premature.

TABLE II. RELATIONSHIP OF MATURITY TO FETAL MORTALITY

FETAL MATURITY	NO. OF CASES	INCIDENCE	DEATHS	FETAL MORTALITY
Premature	29	28%	20	69%
Mature	76	72%	32	42%

Before a common denominator of adequate treatment can be determined, it is necessary that some of the principal predisposing causes of the prolapse of the umbilical cord should be reviewed. The factor of cephalopelvic disproportion was introduced in only one case, and this was terminated by a cesarean section with favorable maternal and fetal results. Abnormalities of fetal presentation presented the greatest predisposing influence to prolapse of the umbilical cord.

TABLE III. RELATIONSHIP OF PRESENTATION TO FETAL MORTALITY

PRESENTATION	NO. OF CASES	INCIDENCE OF PRESENTATION (%)	FETAL DEATHS	FETAL MORTALITY (%)
Vertex	54	52	22	40
Breech	31	29	17	54
Transverse and compound	20	19	13	65

When it is considered that the usual incidence of breech presentation is about 3.0 per cent and that of compound and transverse presentations is about 0.5 per cent, it can readily be seen that these abnormal presentations, when present, are extremely conducive to prolapse of the umbilical cord. In this series, approximately 50 per cent of the breech presentations were frank breeches.

To discuss therapy of this accident of delivery in the light of the multiplicity of factors involved would necessitate individual case analysis. The alternative would be to generalize that the fetus should be delivered with the least possible trauma in the least possible time. The definition of *time* and *trauma* will vary with the obstetrician; therefore, the statistics will evaluate the fetal mortality rate which is, actually, the only tangible evidence of results.

TABLE IV. THE OPERATIVE PROCEDURE AND FETAL MORTALITY

OPERATIVE PROCEDURE	NO. OF CASES	INCIDENCE (%)	FETAL DEATHS	FETAL MORTALITY (%)
Cesarean section	9	8.5	1	12
Breech extraction	18	17	8	44
Version and extraction	21	20	14	66
Forceps	11	10	5	4
Bag	2	2	2	100

TABLE V. COMPOSITE ANALYSIS OF FETAL MORTALITY

	PRESENTATION	CERVICAL DILATATION	TOTAL CASES	DEATHS	FETAL MORTALITY (%)
Premature.—	Vertex	Incomplete	8	8	100
		Complete	2	0	0
	Breech	Incomplete	6	5	83
		Complete	7	3	43
	Transverse and compound	Incomplete	5	4	80
		Complete	1	0	0
Term.—	Vertex	Incomplete	18	10	55
		Complete	26	4	18
	Breech	Incomplete	9	6	66
		Complete	9	3	33
	Transverse and compound	Incomplete	8	6	75
		Complete	6	3	50

The single fetal mortality of the cesarean section series was associated with a premature separation of the placenta. Fetal heart tones were heard prior to surgery, however, so the case was included in this series.

There was no maternal mortality in this series but, with the great incidence of major maternal complications, it becomes apparent that the mother is not infrequently subjected to an unusual amount of trauma. This profound increase in maternal trauma indicates that lack of skill and/or judgment was present on the part of the obstetrician. There will be fetal wastage in this complication of delivery regardless of the type of delivery involved; to subject the mother to unusual trauma is, however, a matter of poor obstetrics. Needless to say, most of the unfortunate maternal complications occurred with internal version and extractions.

TABLE VI.   MAJOR OPERATIVE COMPLICATIONS

COMPLICATION	NO. OF CASES	INCIDENCE (%)
Hemorrhage	15	14
Manual removal of placenta	5	4
Cervical laceration	3	3
Ruptured uterus with hysterectomy	2	2
Dührssen's incision	2	2
Third-degree laceration of perineum	1	1
Total	28	26

Summary and Conclusions

1. One hundred five cases of prolapsed cord were analyzed.

2. The total fetal mortality was 49 per cent.

3. The incompletely dilated cervix accounted for almost three times the fetal wastage when compared to cases of complete dilatation.

4. The mortality rate of the premature fetus was almost double that of the mature fetus.

5. This complication is often associated with abnormal presentations.

6. Treatment should be directed to an improved fetal salvage.

7. Version and extraction are not the treatment of choice save in cases of second twin.

8. More liberal use of the cesarean section is advocated in this condition.

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Department of Case Reports
New Instruments, Etc.

RUPTURE OF THE MID-COLIC ARTERY (ABDOMINAL APOPLEXY) PRODUCING SIGNS OF PELVIC HEMORRHAGE*

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SUDDEN intraperitoneal hemorrhage of pelvic origin in women due to trauma or malignancy occurs fairly commonly. However, the spontaneous rupture of an artery of one of the abdominal viscera is a rare occurrence and this condition has been termed ''abdominal apoplexy.''

Crile and Newell[1] have reported the only case in which the diagnosis was suspected before operation or postmortem examination.

Tanna[2] in 1947 did a thorough review of the literature, listing thirty-two cases and added three more cases from the Charity Hospital in New Orleans.

Becker[3] in 1951 again reviewed the literature and was able to discover thirty-eight cases, including one which he reported for the first time.

M. K. (Clinic No. W84375, Hospital No. IH 8872), a 45-year-old Negro, married, gravida v, para v, was first seen in the accident ward of the Jefferson Medical College Hospital at 10:30 P.M. on Jan. 7, 1946, because of abdominal pain and sudden collapse. Her past history (obtained from her family) revealed that in September, 1945, she had undergone repair of the right flexor pollicis longus tendon and reduction of a right anterior shoulder dislocation at Jefferson Medical College Hospital following a fall through a skylight after reaching through a window for some pastry. There had been no other operations or serious illnesses. Review of systems was within normal limits. There was no past history of dyspnea, precordial pain, edema, headaches, dizziness or ''high blood pressure.'' There was no past history of anorexia, nausea, vomiting, ''indigestion,'' ''heartburn,'' constipation, or diarrhea. There was no history of drug addiction or alcoholism. Menstruation had begun at the age 13 years, every 28 to 30 days, lasting 3 to 5 days with a moderate flow. Her last normal menstrual period had begun on Dec. 28, 1945, and her previous period had been about one month before.

Her present illness had begun about twenty-four hours before her visit to the Jefferson accident ward. A few hours after going to sleep on the evening of Jan. 6, 1946, she was awakened by fairly severe generalized abdominal pain. The pain originally seemed to be somewhat cramplike in character but became sharper as time went along. She felt as if defecation might relieve her symptoms, but a normal bowel movement in the morning on Jan. 7, 1946, produced no change in her discomfort. She did not eat anything during the day, became increasingly nauseated and vomited three or four times. Finally in the evening she began to perspire profusely, complained of increasing generalized abdominal pain, and then fainted. As soon as this had happened she was brought to the accident ward. There was an indefinite history of slight vaginal bleeding just before her admission to that hospital. No history of trauma could be elicited.

General physical examination revealed an acutely ill, somewhat stuporous patient. Because of her condition it was difficult to get any history from the patient. Her skin was cold and clammy. Blood pressure was 88/58, pulse 124, temperature 102° F. Examination of the heart and lungs was not unusual. The abdomen was somewhat obese. Palpation of the abdomen seemed to arouse the patient from her stupor. There was generalized tenderness, more evident in the suprapubic area where there was a somewhat "doughy" sensation. There were no masses and no rigidity. On pelvic examination the external genitals appeared normal; there was a multiparous introitus with moderate vaginal relaxation; the cervix was cystic, lacerated, with minimal endocervicitis; the uterus could not be well outlined but it seemed to be anterior, of about normal size; the adnexa could not be delineated but there was fullness in the cul-de-sac with tenderness. Rectal examination was confirmatory and catheterized urinalysis was negative throughout. Wassermann test was negative (reported later), and hemoglobin was 75 per cent, red blood count 3.2 million, and white blood count 11,300. Hematocrit and serum amylase determinations were not done. The clinical impression was intra-abdominal hemorrhage probably due to ruptured ovarian cyst. Intravenous fluids and plasma had been started so as soon as blood for transfusion was available operative management was deemed advisable.
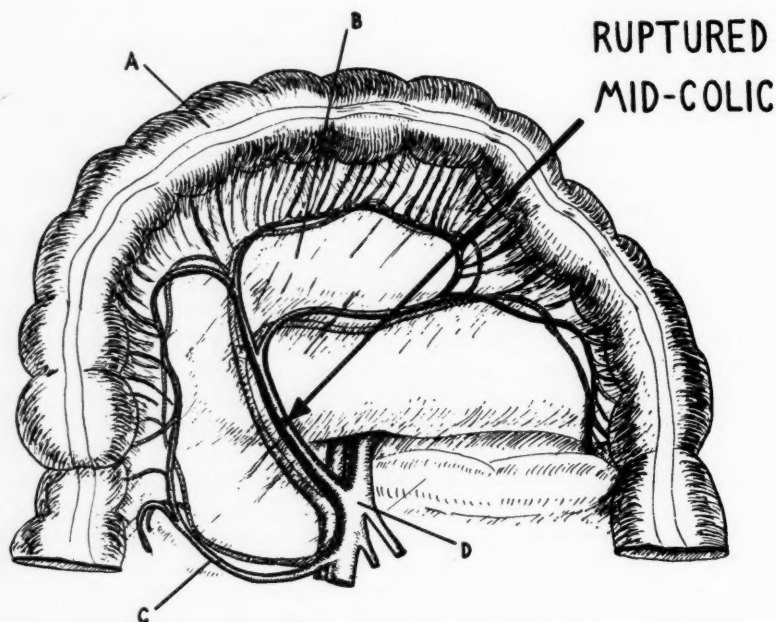
Fig. 1.—Arrow points to site of rupture of mid-colic artery. *A*, Transverse colon. *B*, Transverse mesocolon. *C*, Right colic artery. *D*, Superior mesenteric artery.

Under gas-oxygen-ether anesthesia the abdomen was opened through a low midline incision. As soon as the peritoneal cavity was entered an estimated 1,000 c.c. of free and clotted blood was encountered. A considerable amount of the blood was found in the cul-de-sac. The uterus and both adnexa were carefully examined and no bleeding point could be discovered. The intestines in the pelvis were thoroughly explored and no source of bleeding was seen. The incision was then extended well above the umbilicus so that the upper abdomen could be more adequately examined. The greater omentum was found plastered to the transverse mesocolon with blood oozing from beneath it. Upon gentle elevation of the omentum the mid-colic artery was easily visualized, spurting from a rupture in about its mid-portion. The bleeding area was trebly ligated with No. 0 chromic catgut sutures without difficulty. There was some extravasation of blood in the mesocolon but no circulatory damage was apparent which would require bowel resection. The

stomach and duodenum were then carefully examined and no other sources of bleeding found so the abdomen was closed. The patient had a relatively uneventful postoperative course while in the hospital although she received a total of 1,500 c.c. of blood by transfusion. During her stay in the hospital her systolic blood pressure never rose above 130. While in the hospital complete hematologic survey was done and no abnormalities were noted. She was discharged in good condition on Jan. 23, 1946. Since then she has been followed at intervals in our outpatient clinic. She had a normal cessation of menstruation about three years following operation with no bleeding since that time. She has continued her daily work as a cook and has had no illnesses until September, 1952, when, because of headaches, she was seen by her family physician who discovered that she had hypertension with a systolic blood pressure of 200. This pressure has fallen to 150 as of this week.

Comment

Abdominal apoplexy, according to the review of the reported literature, usually occurs in the older individual with hypertension. The youngest patient was 27, the oldest 80; the mean age in Tanna's series was 53, with men predominating in a ratio of almost 3 to 1.

The basic pathologic process responsible for the rupture of the blood vessel is thought to be arteriosclerosis, although Shallow, Herbut and Wagner[4] emphasize the possibility of the rupture of small "congenital" aneurysm being responsible for the condition.

In 31 of the previously reported cases (38) operation was performed with an operative mortality rate of 29 per cent. The diagnosis was made by postmortem examination in the other 7 cases.

The bleeding in abdominal apoplexy may arise from any vessel within the abdominal cavity. The pain is crampy and dull if the bleeding is confined to the mesentery and becomes severe and sharp producing collapse when the bleeding occurs directly into the peritoneal cavity.

The signs of abdominal apoplexy are those of acute intra-abdominal hemorrhage usually with no well-defined localization.

Summary

1. A case is reported of abdominal apoplexy due to rupture of the mid-colic artery in a 45-year-old woman. The signs and symptoms suggested intra-abdominal bleeding of pelvic origin. The patient was operated upon, the bleeding source ligated, and recovery was uneventful.

2. The 38 previously reported cases are discussed briefly.

3. An operative mortality of 29 per cent in the previously reported cases is stressed.

4. A history of crampy generalized abdominal pain with signs of intraperitoneal hemorrhage without localization, particularly in the older hypertensive patient, should lead one to suspect abdominal apoplexy.

5. The management is ligation of the bleeding blood vessel and bowel resection if indicated.

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A NEW INSTRUMENT IN CONJUNCTION WITH A SIMPLER TECHNIQUE FOR ABDOMINAL PANHYSTERECTOMY

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IT IS desired to present a new surgical instrument which, with certain steps in technique, has facilitated the operation of panhysterectomy.

The instrument is called the "vaginal cuffer" and is shown in Fig. 1.

It consists of a shaft about 6 inches long having at its ends a right-handed and a left-handed curved and slotted director. These come off at an angle of about 90 degrees and the slots accommodate the blade of an ordinary scalpel. Its use is shown in *A* of Fig. 2.

After previous ligation of the round and broad ligaments and the uterine vessels and ample downward dissection of the bladder, the denuded upper vagina has been opened anteriorly by a small incision. The two edges are caught by Allis forceps. The right-sided end of the cuffer is inserted into the right vaginal fornix. While applying moderate upward traction with the instrument a knife blade is moved up and down in the slot making a clean-cut circular incision close to the cervix for about one-third of its circumference to the right.

The left-sided end is then similarly used to incise about one-third of the circumference to the left. The remaining posterior third of the vaginal cuff is then quite visible and can be cut through with scissors to remove the uterus. (In cutting around the vagina as described, it is advisable to catch the full thickness of the wall about every one-half inch with Allis forceps.)

The advantages of the cuffer are as follows:

A. It preserves the full length of the vagina.

B. It tends to prevent damage to surrounding structures by pulling the vaginal vault upward while cutting in an important location.

C. It favors a precise closure of the vaginal wound by uniting clean-cut edges free of "dog ears." Exuberant granulations are rarely seen when the upper vagina is inspected at the time of the final specular examination.

To complete the description of our operative technique, the parametrial areas as shown in the grasp of the two clamps are suture ligated and generally fastened to the lateral angles of the vaginal stump. The vaginal vault is then closed by a continuous suture as shown in *B* of Fig. 2.

The transfixed stumps of the broad ligaments are included in the first and last ties of the closure in order to provide good vaginal support and to narrow the area to be peritonized.

The "four-in-one suture" as shown in *C* of Fig. 2 has for many years been found useful in shortening the final stage of the operation.

It is a simple purse-string suture which approximates: (1) a substantial bite of the posterior vaginal connective tissue; (2) the stump of the right round ligament; (3) the plicated free edge of the reflected bladder peritoneum; and (4) the stump of the left round ligament.
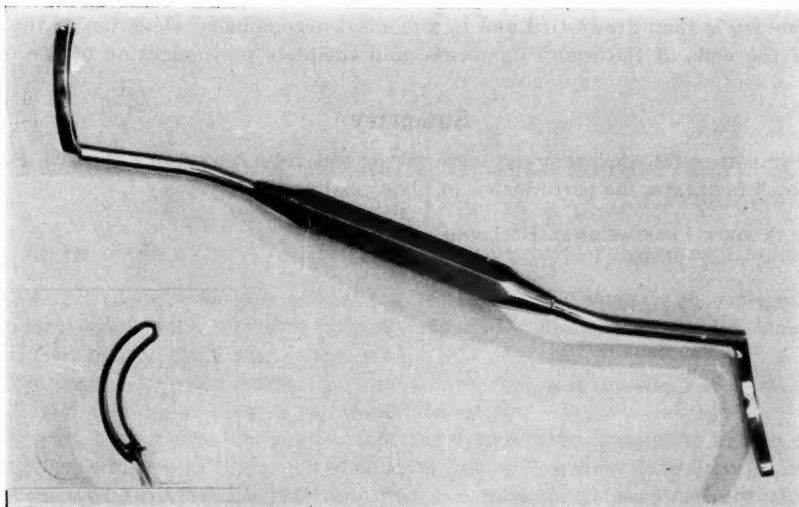
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Fig. 1.

A

Cuffer inserted
around cervix
through vaginal
incision

Full thickness cut
made to beyond
3 and 9 o'clock

"Four in one suture"
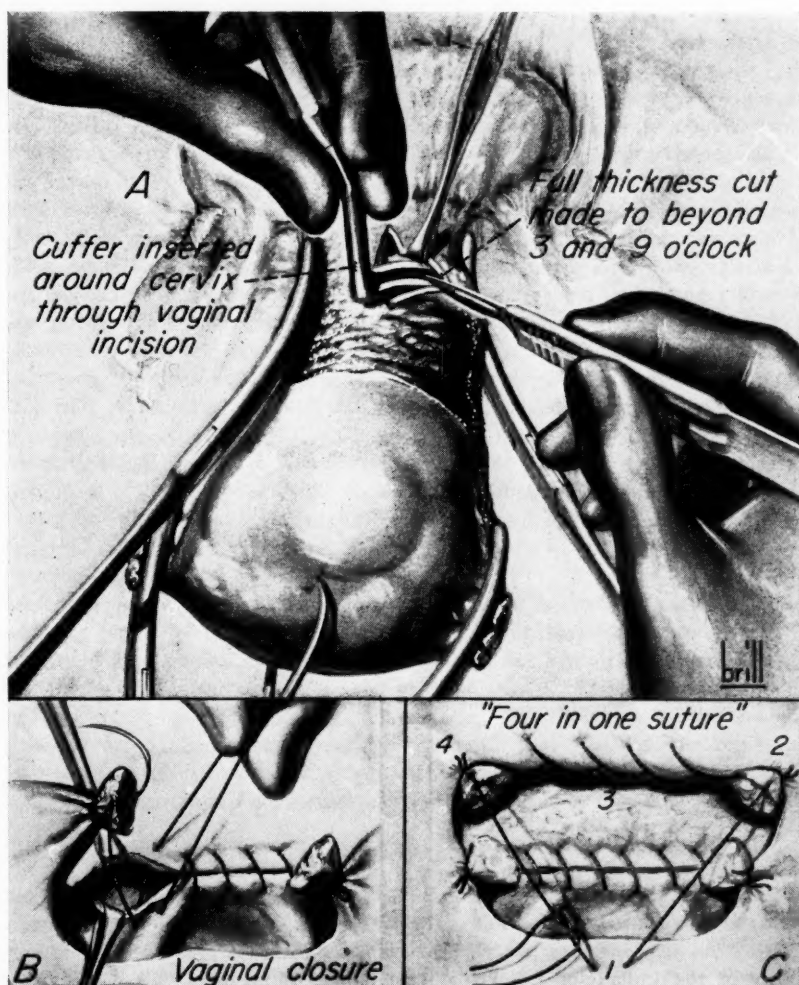
B Vaginal closure

C

Fig. 2.

The suture is then firmly tied and in a moment accomplishes elevation of the bladder, fixation of the ends of the round ligaments, and complete peritonization of the operative area.

Summary

A new instrument, the ''vaginal cuffer,''* has been presented, which, with the ''four-in-one suture,'' facilitates the performance of abdominal panhysterectomy.

GERMANTOWN PROFESSIONAL BUILDING

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*Courtesy of the Philadelphia Surgical Instrument Company.

A CASE OF ENDOMETRIOSIS IN THE EPISIOTOMY SCAR

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ENDOMETRIOSIS in the pelvic organs of the female is frequently encountered, but its occurrence in an episiotomy scar is rarely reported.[2] Because of the infrequency of such an occurrence, the following case is presented.

A 26-year-old white primiparous woman was first seen on Jan. 18, 1951, because of continual mild vaginal bleeding of two weeks' duration.

The past history was irrelevant except for dysmenorrhea consisting of two days of premenstrual lower abdominal pain and abdominal pain on the first three days of menstruation. She was married on April 17, 1947, and had a normal spontaneous delivery of a full-term, male child ten months later, while in a Belgian refugee camp. The puerperium was normal except for weakness and persistent tenderness in the right mediolateral episiotomy scar.

The general physical examination of the patient was normal. Vaginal examination showed a parous introitus with good perineal support. The fundus and cervix were normal. There were no masses or tenderness in the adnexal or parametrial regions. On speculum examination, friable tissue was seen on the posterior vaginal wall in the right sulcus at the site of the healed episiotomy scar. This area bled readily and was about 2 mm. in size. It had the appearance of slightly elevated, circumscribed, granulation tissue. The patient was advised to have a biopsy but refused.

Three months later the patient was again seen because of a sharp pain in the right thigh of eight days' duration. Though vaginal bleeding had ceased, the pain in the pelvis had become more severe, especially at the time of the menstrual flow. Perineal tenderness was now present on sitting or walking. On pelvic examination two changes from the previous visit were noteworthy: (a) Bilateral adnexal tenderness was now present. (b) The site of the previously friable tissue in the episiotomy was now replaced by a slightly elevated, smooth-surfaced, red area which was 2 mm. in diameter. The patient was hospitalized and on March 13, 1951, the cervix was biopsied and the reddened elevated tissue in the episiotomy scar was excised widely.

The pathological report by Dr. William Aronson revealed chronic endocervicitis in the cervical biopsy. "The vaginal wall contained a group of glands resembling those of the endometrium." This was diagnosed as "endometriosis of the vaginal wall." Fig. 1 is a microscopic slide showing a cluster of endometrial glands beneath the squamous epithelium of the vagina.

The subsequent clinical course was uneventful. The patient obtained relief from the pelvic and hip pains by the administration of either methyl testosterone or stilbestrol, but, when she stopped the medication against advice, all of her symptoms returned.

Five months after the operation, the patient stated that she had had tenderness in the right buttocks for two weeks before menstruating. Examination showed no change in the pelvic findings except for a thickening and extreme tenderness in the region of the right adnexa, though the left adnexa were negative. Since the patient has expressed a desire to conceive, she is being treated conservatively for a probable endometriosis of the adnexa.

Comment

The more common sites of endometriosis are the gynecologic organs higher in the pelvis, but endometrial implants occur infrequently in the vagina, especially in the site of an episiotomy scar. Fourteen cases of endometriosis in the perineal scar have been reported in the literature[1, 2, 4, 6, 12] to date.
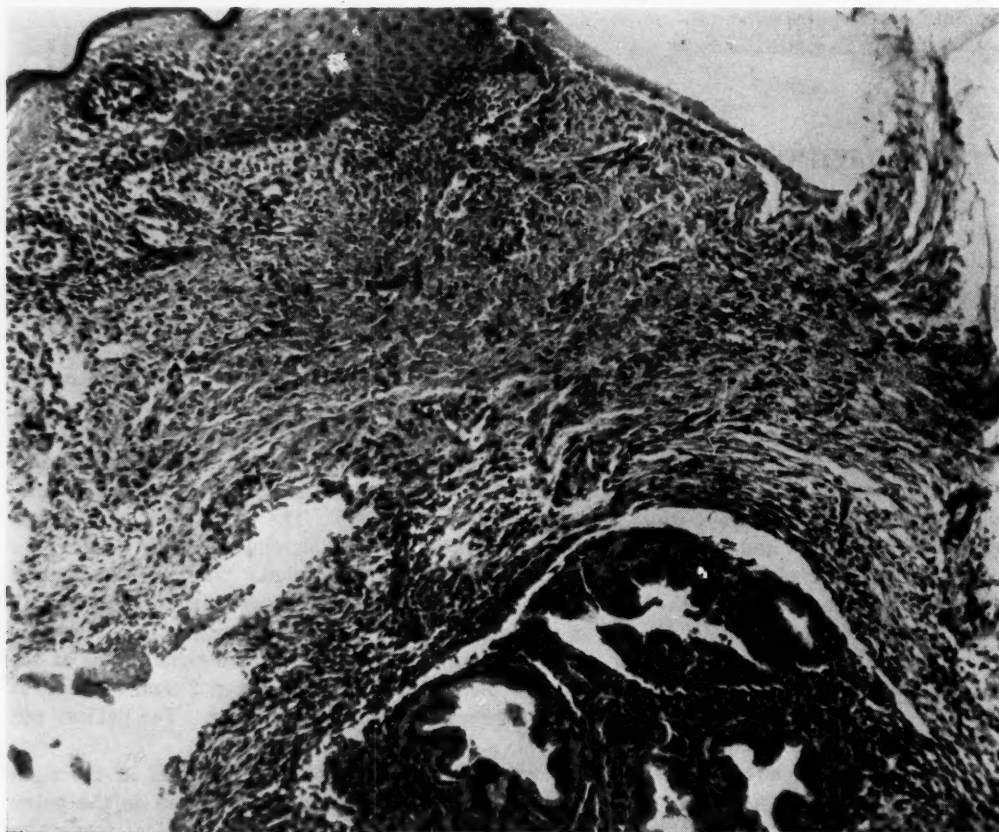
Fig. 1.—Endometrial glands beneath the vaginal squamous epithelium.

Undoubtedly, from the clinical symptoms and signs, this patient has endometriosis in the right adnexal region. Whether the endometriosis in the episiotomy scar was a direct extension or a lymphatic implant from the endometriosis in the region of the right adnexa or had developed independently of the other tissues with endometriosis, cannot be determined. Against its being a direct extension is the fact that, after the vaginal implant was excised, there was no local recurrence of the endometriosis. Possibly, the episiotomy incision may have been made through an area which was already involved with endometriosis that was dormant during the pregnancy.

Novak[7] states, "the prevailing viewpoint at the moment is that the histogenesis of all the cases [of endometriosis] is not the same." An interesting point may be raised in connection with the theory that the shed endometrium is the source of the extrauterine occurrence of endometrial tissue.[5, 7, 10, 13] With the innumerable episiotomies and other vaginal operations and lacerations that occur, if this theory were correct, one would expect to find endometriosis in vaginal incisions much more frequently. Yet the vagina is an infrequent site for the location of endometrial implants. It is probably as Rothman[9] believes, that factors as yet unknown are responsible for the extremely low incidence of endometriosis in the vaginal scars.

Summary

A case of endometriosis of the vagina is reported. This case of endometriosis in an episiotomy scar is associated with apparent pelvic endometriosis involving the region of the right adnexa.

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910 GRAND CONCOURSE

CARCINOMA OF THE BREAST METASTATIC TO THE PERITONEUM AS A SOURCE OF POSITIVE VAGINAL SMEARS

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THE vaginal smear has proved itself to be a valuable adjunct in the detection and diagnosis of female genital cancer.[1, 2, 3] Exfoliation of cells from a primary malignant tumor of the uterus, vagina, or occasionally the tubes[4] is the usual source of the tumor cells appearing in the vaginal smear. Malignant lesions of other organs metastatic to the endometrium or endosalpinx can shed tumor cells that will likewise appear in the smear. Occasionally carcinoma of the ovary, either directly through the tubes or by means of metastatic spread, can also give rise to positive cells. The following case is an unusual one in that the primary lesion was a scirrhous carcinoma of the breast, and in addition the surfaces of the secondary lesion from which the exfoliated cells were derived were contiguous with the peritoneal cavity and not in contact with the internal surfaces of the uterus or tubes.

Mrs. B. P., a 66-year-old woman, was first admitted to the Massachusetts General Hospital in October, 1946, at which time a right radical mastectomy was performed. The pathological report was scirrhous carcinoma of the breast with metastases to all 7 axillary lymph nodes.

She was asymptomatic for 5 years. In October, 1951, at the age of 71, she noted the onset of a vaginal discharge. Pelvic examination performed 2 weeks later was negative, but a vaginal smear was reported as positive (Fig. 1). A second vaginal smear two weeks later was also positive.

The patient was readmitted to the hospital on Nov. 25, 1951. A preliminary dilatation and curettage were grossly negative and examination of the pelvic organs under anesthesia revealed the uterus and adnexa to be of normal size. However, because of the presence of a firm irregularity in the cul-de-sac and of ascites, exploratory laparotomy was carried out. The peritoneal cavity contained 300 c.c. of straw-colored fluid and was studded with carcinomatous implants. The nodules were present over the surfaces of the omentum, broad ligaments, and tubes. The ovaries and uterus were negative. Ascitic fluid was obtained for cytological study. Bilateral oophorectomy was carried out to determine what effect the removal of these organs would have on the metastatic disease. At this point it seemed quite apparent that the peritoneal implants were the source of the positive tumor cells appearing in the vaginal smear. The tubes and fundus of the uterus were therefore removed to allow thorough pathological study of these organs and rule out a genital source of the tumor cells. The remainder of the uterus was thoroughly inspected, curetted, and closed. The patient made an uneventful recovery and was discharged on 1.5 mg. of ethinyl estradiol daily.

Pathological examination of the operative specimen confirmed the presence of metastatic carcinoma of the omentum, broad ligaments, and serosal surfaces of the tubes. The ovaries, the tubal walls and endosalpinx, and the uterus were negative for tumor. The histological appearance of the tumor was consistent with a breast origin. Cytological examination of the ascitic fluid revealed tumor cells similar to those found in the previous vaginal smears (Fig. 2).
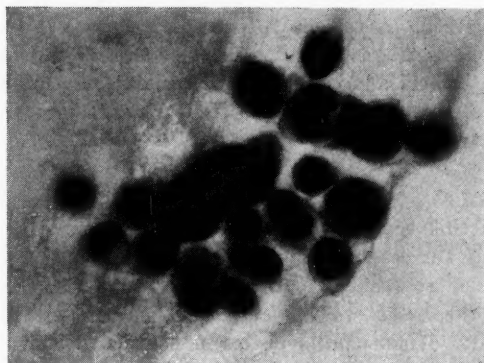
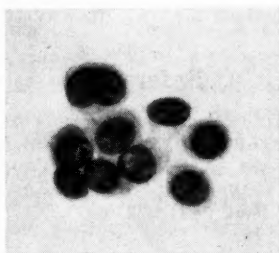Fig. 1.—Preoperative vaginal smear showing clumps of malignant cells.   (×512, reduced one-fourth.)

Fig. 2.—Ascitic fluid showing clumps of malignant cells similar to those found in the vaginal smear.   (×512, reduced one-fourth.)
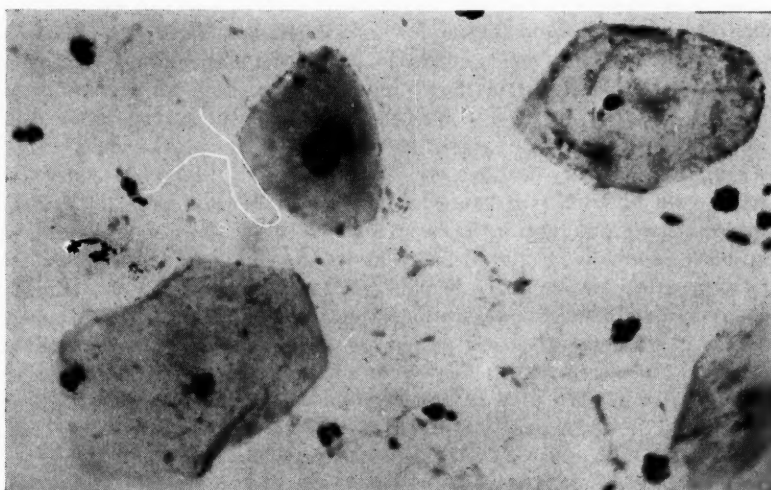

Fig. 3.—Postoperative vaginal smear showing only cornified cells indicating estrin effect. (×512, reduced one-third.)

Since operation the vaginal smear has been negative on four different occasions and has shown only marked estrin effect (Fig. 3). The patient was readmitted twice in January, 1952, for abdominal paracentesis. Radioactive colloidal gold was administered intraperitoneally on Jan. 29, 1952. After one further paracentesis the patient went along without accumulating fluid until August, 1952. Her last admission was in September, 1952, at which time the intraperitoneal administration of radioactive colloidal gold was once again carried out. Cytological examination of the ascitic fluid since radioactive colloidal gold therapy has been negative.

Summary and Conclusions

1. The patient in this report was found to have a positive vaginal smear 5 years after radical mastectomy for carcinoma of the breast.

2. At operation and subsequent pathological examination there proved to be metastatic carcinoma from the breast to the peritoneal surfaces of the omentum, broad ligaments, and tubes, but no demonstrable lesion in contact with the lumina of the genital tract.

3. The ascitic fluid removed at the time of operation contained tumor cells similar to those found in the vaginal smear.

4. Vaginal smears taken subsequent to closure of the communication between the peritoneal cavity and the vagina have remained negative.

In light of these observations we must conclude that the source of tumor cells in this unusual case was the ascitic fluid making its way through the tubal ostia and thence to the uterus and vagina.

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PRIMARY OVARIAN CYSTADENOCARCINOMA: SOLITARY METASTASIS TO CONTRALATERAL INGUINAL LYMPH NODE

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THE occurrence of a contralateral solitary extrapelvic metastasis as the first clinical evidence of an ovarian carcinoma has rarely been described in the literature. The case history to be presented involves a contralateral inguinal lymph node metastasis whose primary origin, not recognizable at the time of metastasis, was subsequently found to be in the pelvis. The prominence of the metastasis long before the primary source could be ascertained, and the peculiar mode of metastasis of the pelvic carcinoma deserve consideration.

Case Report

A 63-year-old white patient, para i, gravida i, was admitted to Barnert Memorial Hospital on Aug. 4, 1952, with a complaint of localized intermittent pain in the right inguinal region of six weeks' duration. The remainder of this patient's history was noncontributory. Blood count and urinalysis were within normal limits. General physical examination was considered normal except for delineation of a small nontender mass ¾ inch in diameter in the right inguinal region. A diagnosis of right femoral hernia was made and on Aug. 6, 1952, the patient was taken to the operating room for a right femoral herniorrhaphy. However, after incision of the right inguinal area, the mass previously palpated in this region was found to be an enlarged lymph node. This lymph node was approximately ¾ inch in diameter, well encapsulated, and attached to the surrounding fat by a vascular pedicle. The node was found below the right inguinal ligament and there was no evidence of infiltration into the surrounding tissue. A femoral hernia was not present. Enucleation of the lymph node was done. Pathologic examination of this tissue yielded a report of metastatic adenocarcinoma of the right inguinal lymph node.

A search was immediately begun for a primary source of the carcinoma. Gynecologic consultation on Aug. 7, 1952, revealed the following: The external genitals and vagina were considered to be normal and the cervix was adjudged as small, anterior, lying in the axis of the vagina, mobile and normal in consistency and appearance. The uterus was described as anterior, firm, and irregularly enlarged to the size of a 10 weeks' gestation. Both adnexa were unequivocally considered normal.

A diagnostic curettage was advised by the gynecologic staff and this procedure was performed on Aug. 11, 1952. The amount of tissue obtained by curettage was minimal, appeared normal, but was considered to be insufficient for thorough histopathologic diagnosis. The uterus was perforated by the curette during the procedure and further attempts at more extensive curettage were immediately abandoned. The patient was given Dicrysticin and was watched carefully but the postoperative course was not attended by any sequelae. X-ray investigation was begun on Aug. 8, 1952, and completed on Aug. 21, 1952. X-rays of the bony pelvis, long bones, chest, intravenous pyelogram, gastrointestinal series, and barium enema did not reveal any evidence of a primary growth. The Papanicolaou smear report was simply Grade II cells. Thorough physical re-examination including pelvic re-evaluation was essentially negative. The patient was discharged on Aug. 23, 1952, in good condition and with no complaints. The discharge diagnosis was simply metastatic inguinal adenocarcinoma (right), primary source unknown. It was decided to continue further observation of the patient through frequent clinic visits.

On Nov. 13, 1952, about eleven weeks after discharge from the Barnert Memorial Hospital, this patient was admitted to the gynecologic service with a complaint of left lower quadrant pain of six weeks' duration. Blood count and urinalysis on admission were normal. Abdominal examination elicited mild tenderness in the left lower quadrant. There was a large palpable mass in this area. Pelvic examination showed no change in the external genitals and vagina. The cervix was normal in all respects but was deviated markedly to the right. The uterus was anterior, firm, nontender, and seemed to be attached to a slightly tender, irregular, nondisplaceable cystic mass, 12 by 14 cm. in diameter. This mass extended from the uterus to the left lateral pelvic wall. The diagnosis made at this time was cystadenocarcinoma of the left ovary.

On Nov. 14, 1952, a laparotomy was performed. The findings at operation were as follows: An irregular multilocular, thin-walled, cystic ovarian mass 12 by 14 cm. in diameter was found extending from the left adnexa to the anterior surface of the rectosigmoid and cul-de-sac posteriorly, and the anterior surface of the fundus. The right adnexa were grossly normal. There was no lymph node involvement along the course of both ureters. No metastasis was observed on the surface of the liver, peritoneum, or omentum.

The operation performed was a total abdominal hysterectomy, separation of the left ovarian mass from the surface of the sigmoid and cul-de-sac, bilateral salpingo-oophorectomy, removal of the upper segment of the vagina and exposure of both ureters.

The postoperative course was uneventful and this patient was discharged on Nov. 23, 1952, the ninth postoperative day, in good condition. A course of postoperative radiation was begun shortly after discharge from the hospital. A follow-up examination in the clinic six weeks after operation revealed no complaints and no evidence of metastases.

Comment

The pattern of metastasis of a left ovarian carcinoma to a contralateral inguinal lymph node without traversing intervening organs is an unusual one. The existence of adhesions between the carcinomatous mass and the uterus suggests the possibility of establishment of collateral lymphatic drainage in the area of adhesions.

The lymphatics of the left ovary may communicate with (1) the superficial lymphatic vessels that lie beneath the visceral peritoneum of the uterus: or (2) collateral lymphatic vessels coursing through the area of adhesions. Either group of lymphatic vessels may intercommunicate with the round ligament lymphatics in the region of either uterine cornu. One of two round ligament lymphatic vessels frequently empty into the superficial inguinal glands. These are the postulated paths of metastasis of this left ovarian cystadenocarcinoma whose first manifestation appeared in a right inguinal lymph node.

Summary

1. A case of left ovarian adenocarcinoma metastasizing to a right inguinal lymph node has been presented.

2. It is curious to note that a lone contralateral metastasis was the first evidence calling attention to the primary lesion in the pelvis.

3. The probable path of metastasis of a left ovarian adenocarcinoma to a contralateral superficial inguinal lymph node has been presented.

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INTUSSUSCEPTION OF THE UTERINE TUBE*

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A RATHER unusual variant of tubal abortion was recently observed. Mrs. E. S., aged 36 years, white, para i, gravida ii, was hospitalized on July 17, 1952, complaining of severe intermittent abdominal pain of four days' duration. Her last menstrual period occurred normally on June 14, 1952, thirty-three days prior to hospitalization. On the day of hospital admission the pain became more acute and was referred to the right lower quadrant. In addition, she developed right shoulder pain and had fainted once.

Physical examination revealed a pale woman in acute distress. Her temperature was 97.4° F., blood pressure 100/64, and pulse 100. The abdomen was slightly distended and tender. There was marked rebound tenderness, especially over the right lower quadrant. Vaginal examination revealed bilateral adnexal and uterine tenderness. There were no palpable masses.

Urinary findings were normal; red blood count 3.5 million, hemoglobin 10.8 Gm., and white blood count 8,800.

The patient was operated upon with the preoperative diagnosis of ruptured tubal pregnancy. At the time of surgery, intussusception of the right uterine tube with partial tubal abortion was discovered. Right salpingo-oophorectomy was performed. Since a description of intussusception of the uterine tube could not be found in the American or English literature, this condition seems worthy of reporting.

Fig. 1 is a diagrammatic representation of the gross specimen, showing the region of telescoping at the junction of the middle and outer thirds of the right tube. Protruding through the dilated fimbriated end but still attached to the tube may be seen both conceptus and surrounding blood clot.

Fig. 2 is a schematic drawing of the invaginated tube in longitudinal section.

Fig. 3 is a photomicrograph of the tissue cut through the telescoped area (Fig. 2, *a*). It reveals three concentric circles, *A, B,* and *C,* each of which is a cross section of the tube (Fig. 2 and Fig. 3). *B* and *C* comprise the intussusceptum while *A* is the intussuscipiens. It will be noted that the everted villi of *B* are in contact with the mucosal folds of *A*.

Intussusception of the uterine tube was first reported in 1907,[1, 3] and there are to date a total of only seven case reports, all in the foreign literature.[1-7] This condition has heretofore been designated invagination, eversion, and/or inversion of the uterine tube. Of the 7 cases reported, 5 were associated with tubal abortion (Table I). The report of Grosdov[5] is of particular interest. He observed two instances of "invagination and eversion" of the tube in his 723 cases of extrauterine pregnancy, an incidence of 0.27 per cent.

It seems probable that the actual incidence of intussusception of the tube is higher than the rarity of case reports would indicate. It is possible that the colicky pain, so common in tubal pregnancy, might arise from this condition. Should the conceptus and clot become detached from the tube and extruded into the abdominal cavity, the tubal invagination could correct itself, and no longer be recognizable. Thus intussusception could be one cause of the pain associated with tubal pregnancy.

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*Presented at a meeting of the Chicago Gynecological Society, Nov. 21, 1952.
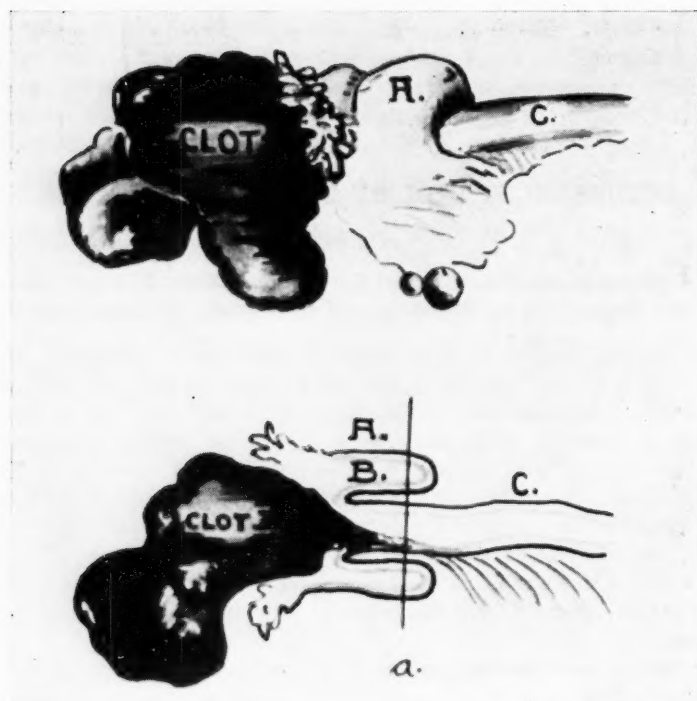
Fig. 1.

Fig. 2.

Fig. 1.—Drawing of gross specimen.

Fig. 2.—Cross section of tube showing intussusception and region *a* from which photo-micrograph was made.
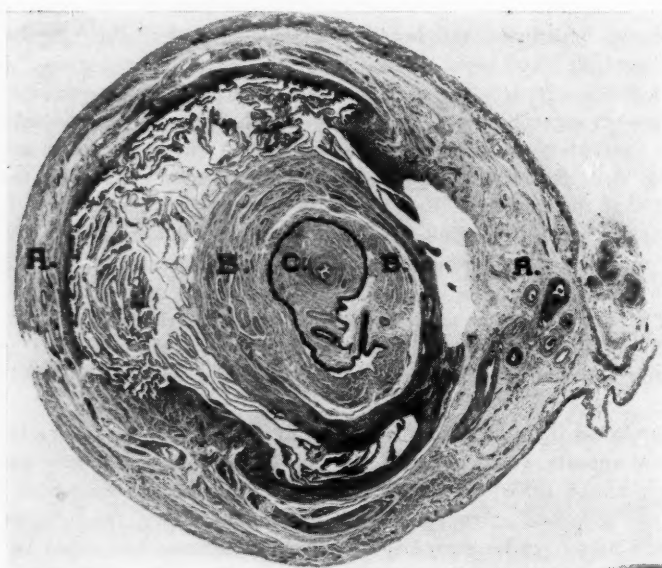

Fig. 3.—Photomicrograph through *a*, Fig. 2, showing intussuscipiens *A*, and intussusceptum *B* and *C*.

TABLE I. SUMMARY OF ALL CASE REPORTS ON INTUSSUSCEPTION OF UTERINE TUBES

	YEAR	AGE	PARA	TUBE	REMARKS
Falk, E.	1907	23		Rt.	
Gogoberidse, B.	1929	29	i	Rt.	
Pistuddi, A.	1930	45	i	Lt.	Not pregnant
Grosdov, T. M.	1932	21	0	Lt.	
		26	i	Rt.	
Caprio, G., and Buño, W.	1940	31		Lt.	
Giordano, L.	1950	32	ii	Rt.	Not pregnant
Authors'	1952	36	i	Rt.	

Summary

A case of intussusception of the uterine tube is reported. It is suggested that this condition is not as rare as the paucity of references in the literature indicates, and that it may be the cause of the colicky pain so often observed with tubal pregnancy.

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CARDIAC ARREST DURING CESAREAN SECTION

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CARDIAC arrest is as dramatic a catastrophe as can be encountered in the practice of medicine, and one that until the past few years has not received sufficient attention in the literature. It may occur during any type of surgical procedure, although cardiac or pulmonary surgery seems most prone to initiate this disorder. Likewise, it may occur with the use of almost any anesthetic. During the past few years many excellent articles[1-5] have appeared on this subject, especially the diagnostic and treatment phases, to which the reader is referred.

In a brief review of the literature no cases similar to ours were noted. Therefore, a case which occurred during cesarean section, *prior* to the delivery of a normal live infant and followed by death of the mother, is reported. The estimated duration of complete cardiac arrest in this case was approximately 8 to 10 minutes.

Case Report

Mrs. E. A., a 34-year-old gravida i, para 0, Latin-American woman, was admitted to the hospital at 5:45 P.M. on Dec. 21, 1950, stating that labor pains had begun at 1:00 P.M. the same date. She had noted no loss of "water" or bloody discharge. No physician had been consulted during her pregnancy prior to admission.

Past and family history were negative.

Physical examination on admission revealed blood pressure 140/90 with temperature 98.2° F., pulse 88, and respirations 20. The patient's weight was estimated to be in excess of 225 pounds, height approximately 5 feet, 6 inches, with obvious generalized "puffiness" but no gross pitting edema. There was a Grade 2 systolic murmur at the pulmonic area of the heart, fading to a Grade 1 systolic murmur at the apex. Abdominal examination revealed a term-sized uterus, the fetus in left occipitoanterior position with the head dipping very slightly into the pelvis. Uterine contractions were every 3 to 4 minutes, lasting 50 seconds. The fetal heart rate was 144, regular, and in the left lower quadrant. Rectal examination revealed 2 to 3 cm. dilatation, 75 per cent effacement, minus 3 station, membranes intact, and the sagittal suture in the right oblique diameter of the pelvis.

Laboratory examination was essentially normal with hemoglobin 84 per cent, and red blood count 4.05 million. The Kline test and urine specimen were negative.

Pregnancy was complicated by cephalopelvic disproportion and mild pre-eclampsia. Cesarean section was deemed likely but a further trial of labor was recommended.

At 9:00 A.M. on December 22 the temperature was 99.2° F., uterine contractions were of good character and duration, and rectal examination revealed 100 per cent effacement with 5 cm. dilatation of the cervix, and the head still at a minus 3 station. There was no molding or caput. The membranes were intact. At 5:00 P.M. December 22, with no evidence of further progress, and with development of marked caput and molding, penicillin was begun prophylactically prior to the cesarean section. The blood pressure at that time was 120/80, the fetus was alive, and the membranes were still intact.

At 5:45 P.M., December 22, a low cervical cesarean section was begun through a left paramedian lower abdominal incision under spinal anesthesia with Heavy Nupercaine,* dosage 10 mg. The anesthetic level reached T$_{5-6}$. Routine intravenous electrolytes and blood

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*Heavy Nupercaine (a-butyloxycinchoninic acid-y-diethylethylenediamide hydrochloride in 5 per cent dextrose solution): Ciba Pharmaceutical Products, Inc., Summit, N. J.

had not yet been started. The bladder flap had just been developed when at 5:55 P.M. the anesthetist suddenly noted no pulse, respiration, or obtainable blood pressure. Intra-abdominal palpation of the aorta revealed very faint pulsations with the heart itself beating approximately 48 times per minute and regularly. Incision of the diaphragm for massage of the heart was impossible due to the presence of the intrauterine fetus filling the abdominal cavity. Cardiac massage through a chest incision was decided against because of the great danger of losing *both* mother and infant due to the extra time element involved. Consequently, while other efforts were being prepared for, the heart was manually massaged at approximately 70 times per minute through the intact diaphragm for one minute, but with complete cessation of the heartbeat during that time. Vena puncture was impossible due to the "collapsed" vessels. Oxygen by mask with artificial respiration was being administered. Because the fate of the mother was probably beyond control, the baby was delivered at 5:57 P.M. through the previously developed low cervical flap, with a transverse uterine incision. The infant was living, showed mild asphyxia, but cried fairly readily after 1½ minutes, and eventually quite lustily. Massage of the mother's heart was again continued intra-abdominally and by 6:06 P.M. the heart had resumed beating at a rate of 120 times per minute with a blood pressure of 50/?. At 6:08 P.M. a small needle was finally inserted into a vein and intravenous procaine (0.1 per cent) begun. By 6:10 P.M. respirations were catchy but moderately deep at 24 times per minute and the blood pressure rose to 80/40. Then Oenethyl,* 25 mg. intravenously, was given and the blood pressure rose to 110/70. At 6:50 P.M. 10 per cent glucose was given with the blood pressure still stable at 110/70, with respirations 24 and pulse rate 52. When this fluid was discontinued the patient was moved back to her room, groaning moderately, moving the right arm slightly, but with sluggish pupillary reflexes.

Prophylactically, against thromboembolism, calcium levulinate was given intra-venously in daily doses of 1 Gm. along with vitamin E, 100 I. U. intramuscularly every 8 hours. Penicillin, 300,000 units twice a day, aspiration of mucous secretions, turning of the patient routinely, and oxygen therapy were ordered. At 9:25 P.M., Dec. 22, 1950, postoperatively, the patient had a convulsion with positive Babinski reflexes bilaterally, rigidity of the neck muscles, and was apparently beginning to develop "decerebrate rigidity." On Dec. 23, 1950, the temperature rose to 101° F. axillary, oxygen was being given periodically, and on Dec. 24, 1950, at noon, a retention catheter was inserted. Blood pressure was 134/90 at that time. The patient did respond slightly to stimuli, opened her eyes, looked about, but was not coherent. On Dec. 25, at 11:30 A.M. the patient died with decerebrate rigidity, characterized by coma and generalized convulsions.

At the age of 3 months the infant seemed normal in all respects.

Comment

A more inopportune time for the development of cardiac arrest, as occurred in this case prior to delivery of the infant during cesarean section, is difficult to imagine. It demonstrates only too well the suddenness with which obstetrical emergencies may arise. Under the circumstances, to have obtained a live baby seems fortunate indeed. However, the maternal mortality cannot be taken lightly. In this case the question was not so much mother's life versus infant's life, but instead the probable death of *both* mother and infant, versus the probable life of the infant.

An unfortunate train of circumstances developed in this case. The routine intra-venous fluids had not yet been started on the patient when the cardiac arrest developed. Consequently, it was impossible to administer promptly either intravenous electrolytes or blood because of the deep-seated, "collapsed" blood vessels in a very large woman. By the time the anesthetist had inserted a needle large enough to carry whole blood into a vessel the patient's blood pressure had risen sufficiently that circulation and oxygenation seemed adequate.

*Oenethyl (2-methylaminoheptane): Bilhuber-Knoll Corp., Crane Street, Orange, N. J.

In regard to the dosage of Heavy Nupercaine used, it must be stated that this was a maximum dose but it was used on a very large patient and the anesthetic level never exceeded the height of T_5. Even after spontaneous respirations were resumed, costal movement showed no evidence of paralysis above this level. Presumably this crisis was caused by a "sensitivity" to Nupercaine, although pregnant women are notoriously susceptible to all spinal anesthetic agents.

The case is presented, not for its rarity alone, but primarily to provoke awareness and foresight among obstetricians and other physicians engaged in the practice of obstetrics.

Summary

A case of cardiac arrest occurring during cesarean section under spinal anesthesia is reported. Arrest occurred prior to delivery of an apparently normal live infant but was followed by death of the mother on the third postpartum day.

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MEDICAL ARTS BUILDING
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RAYMONDVILLE, TEXAS

INTESTINAL HERNIATION FOLLOWING UTERINE PERFORATION

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THE occurrence of uterine perforation accompanying criminal or therapeutic abortion is not uncommon and seldom presents a major surgical problem. However, the presence of such perforation accompanied by trauma to extrauterine organs or by extrauterine infection is best managed by radical surgery as well as extensive antibiotic therapy.[1] Only three cases similar to the following were found in a review of American literature for the last thirteen years.[2,3,4]

Case Report

J. P., aged 39 years, para 0, gravida i, was admitted at 3:00 A.M. following a self-induced abortion (reputedly accomplished with a toothbrush) of a 3½ months' gestation during the previous day. She arrived at the hospital via taxi but on examination was found to be in a shocklike state with an acutely tender, boardlike abdomen. The placenta was found in the vagina with slight external bleeding. When the placenta was lifted from the vagina a loop of small bowel followed it onto the examining table. In a brief period this loop enlarged until approximately 4 ft. of ileum lay outside the vagina. This ileum had been totally stripped from its blood supply along the mesenteric surface as indicated in Fig. 1. The patient was immediately taken to the operating room and preparations were made for surgery. She was also given 1 million units of penicillin and 1 Gm. of streptomycin preoperatively.

Approximately two hours after hospital admission, the abdomen was entered through a Pfannenstiel incision with the patient receiving gas, oxygen, and ether anesthesia. When the peritoneal cavity was entered, about 100 c.c. of dark serosanguineous fluid was encountered but no free bleeding occurred. The uterus was found enlarged to the size of a 3½ months' gestation, and when it was lifted into the incision, a jagged 2 cm. perforation on the posterior surface was apparent. There was no free bleeding at this site. A second point of perforation, about 3 cm. long, was also found in the base of the right broad ligament extending into the lower uterine segment. Through this perforation prolapsed the previously mentioned ileum. The herniated intestinal tissue was brought back into the pelvis in the hope that some degree of viability might be present, but absence of mesentery throughout its entire length had resulted in gangrene not only in this portion of the gut but also for a distance of about 5 cm. on either side of that ileum which had not been extruded. This tissue was therefore wrapped in gauze and laid upon the abdomen above the incision.

A subtotal hysterectomy was performed with multiple clamps on the broad ligaments and uterine arteries bilaterally. The point of perforation at the base of the broad ligament was incorporated in the excised tissue and the remaining tissue edges closed with a running chromic suture to control bleeding. The round ligaments were sutured to the cervical stump bilaterally and the entire site peritonized with the previously taken bladder flap.

Despite blood administered during surgery, the patient's blood pressure could not be detected while the hysterectomy was being performed and 1,500 c.c. of whole blood was administered rapidly during the remainder of the procedures. Simultaneously an ampule of Levophed was administered intravenously in 1,000 c.c. of 5 per cent glucose in saline. Thereafter her blood pressure stabilized at approximately 140/90; nevertheless, for one hour she received only oxygen by mask.

The ileum was now clamped with intestinal clamps at the point where the blood supply was obviously adequate and the gangrenous portion was resected. The free edge of the mesentery was not bleeding and was only about 8 in. long despite the amount of bowel which had been stripped off. Therefore, with the patient's general condition in mind, a simple end-to-end anastomosis was performed with an inner layer of continuous and an outer layer of interrupted mattress sutures and the free edges of mesentery were sutured to one another to exclude any defects in the mesenteric continuity.

The abdomen was closed in layers and a Cantor tube was inserted nasogastrically as soon as the patient was reactive. For the next four days the patient received 2 million units of penicillin and 3 Gm. of streptomycin daily with intravenous fluid intake determined by her urinary output.

Fig. 1.—Extruded bowel showing absence of mesenteric attachment.

Postoperatively the patient developed slight abdominal distention and an abdominal flat plate indicated some obstructive process in the small intestine, but peristalsis was never totally absent and she began to pass flatus and loose stools on the fourth postoperative day. At no time did her temperature rise above 100.2° F. and her convalescence thereafter was rapid, punctured only by an episode of superficial thrombophlebitis in varicosities of the right leg on the tenth postoperative day. This responded quickly to conservative therapy.

Comment

The operators, faced with the unusual nature of this case, were conscious of a considerable lack of experience at the outset. The fact that the patient survived following such an extensive physical insult and marked peritoneal infection is remarkable. In retrospect, we suggest at least one major change in operative procedure were a similar case encountered, namely, that the extruded bowel be left exteriorized, clamped in the abdominal cavity, and removed via the vaginal route, thereby reducing the probabilities of introducing additional contamination into the peritoneal cavity.

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A CASE OF DISSECTING ANEURYSM OF THE AORTA CAUSING MATERNAL DEATH AT SEVEN MONTHS WITH POSTMORTEM CESAREAN DELIVERY OF A LIVE PREMATURE INFANT*

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Akron, Ohio

(From the Akron City Hospital)

DISSECTING aneurysm of the aorta has been described by Schnitker and associates as a rare complication of pregnancy. In their review of the literature through 1944, a total of 49 females with the disease under the age of 40 were reported. In 24 of these patients the lesion was associated with pregnancy. They suggested the possibility of a disturbance in lipoid metabolism during pregnancy which may cause an alteration in the media of the blood vessels and predispose to a dissecting aneurysm.

Of their 24 cases, 2 occurred post partum and two with the onset of labor. The other 20 cases all occurred at varying times during pregnancy, thus eliminating to a large extent the factor of the trauma of labor as a causative element. The average gestation of the undelivered patients was 36 to 40 weeks. In 6 instances a hurried cesarean section was performed and 3 viable infants were delivered. (The article does not state whether the sections were performed before or after the maternal death except in one case where the mother survived for three years.)

The present case is reported because of the rarity of the condition in pregnancy and because a postmortem cesarean section was performed and a live infant obtained.

Case Report

Mrs. E. M., aged 42 years, was admitted to the medical service of the hospital at 5:25 A.M. on Aug. 15, 1952, complaining of severe pain in the base of the neck extending up to the occipital region. The pain had awakened her during the night and was accompanied by "chills and sweats." The patient then became nauseated and vomited. No blood was present in the vomitus. The pain was so severe that the patient was given ¼ grain of morphine sulfate in the emergency room on the way to the floor. The pain was still very severe when she was first examined by the intern thirty minutes later.

The past history was noncontributory. There was no history of heart disease or hypertension and the patient stated she had never been ill before. She had had no shortness of breath and no edema during the present pregnancy. She had had no surgery.

The last menstrual period had occurred about Jan. 3, 1952, giving an estimated date of confinement of Oct. 10, 1952. She had had three previous pregnancies, all carried to term with three live children aged 19, 16, and 6 years.

Initial physical examination revealed a patient in acute distress with skin cold and clammy and color very pale. The blood pressure was 124/96 and the pulse, which was reported very weak, was 74. The temperature was 97° F. The respirations were 28 and labored. A blowing systolic murmur was heard over the entire precordium. The lungs were clear. The physical examination was otherwise negative except for the presence of a 7 month intrauterine pregnancy with a fetal heart rate of 160.

With a tentative diagnosis of coronary occlusion, the patient was placed in an oxygen tent and during the morning seemed to improve. At twelve-thirty noon, just seven hours after admission, the patient's husband who was visiting her, called the nurse to report that she was having difficulty breathing. She was cyanotic, the respirations were

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shallow and labored, and the pulse weak and thready. The medical resident was called and, when a pulse was no longer detected, intracardiac Coramine 1.5 c.c. was administered. The patient died at 12:45 P.M.

A postmortem cesarean section was immediately performed and a 1,450 gram female infant was delivered by breech extraction through a classical incision at 12:55 P.M. just ten minutes after the death of the mother. The infant gasped spontaneously but cried only after six to eight minutes' resuscitation with a tracheal catheter and oxygen. The infant did well after an initial few days of atelectasis and was discharged on the fortieth day of life when she weighed 2,355 grams.

The laboratory reports which were received only after the patient's death revealed a red count of 3.5 million with 68 per cent hemoglobin, a white count of 11,000 with 89 per cent neutrophils, 10 per cent lymphocytes, and 1 per cent monocytes. The Kahn test was negative. The electrocardiogram showed only left axis deviation and diphasic T wave in leads V_3 and V_4. The cardiac rate was 75 and the rhythm was regular. A chest film was not obtained.

The autopsy revealed a dissecting aneurysm of the arch of the aorta which started in the first part of the ascending aorta and extended about to the junction of the transverse and descending aorta. There was a further rupture of the outer portion of the aorta about 2 cm. beyond the origin of the initial dissection with a pericardial cavity full of blood which had produced a terminal cardiac tamponade.

Comment

The legal and moral aspects of postmortem cesarean section have been discussed by Lattuada recently, who also reviewed the literature between 1937 and 1950. He concluded that a physician is morally obligated to attempt to save the life of a child in the event of the death of an undelivered patient with a viable fetus. In the United States during the thirteen-year period reported, there were 10 cases of postmortem cesarean section with delivery of a live fetus. There were only 21 cases reported in the entire world literature.

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Department of Reviews and Abstracts

Review of New Books

Gynecology

Gynekologische Endokrinologie. By Robert Wenner, Privat-Dozent in Obstetrics and Gynecology at University of Basel, Switzerland. 360 pages with 110 illustrations, Basel, 1952, Benno Schwabe and Company. Geb. Fr. 28.

This volume is a compendium of current knowledge of endocrinology as it affects gynecology. The book is divided into four portions, which deal with the chemistry and pharmacology of the various hormones, normal hormonal conditions in various phases of life, diagnosis, and treatment of endocrinological disturbances. A complete bibliography is included. The book is profusely illustrated with excellent photomicrographs, colored plates, and tables.

A very large amount of information is presented. Probably because of this, a rather elementary approach is manifest.

This volume is unusually easy to read. It should be an excellent, small, ready reference. It embodies, in one source, information which would ordinarily require considerable search.

BRUCE A. HARRIS, JR.

Gynakologische Strahlen-Therapie. By Richard Kurt Kepp, M.D. 232 pages with 64 illustrations. Stuttgart, 1952, Georg Thieme Verlag, Agents: Grune & Stratton, Inc. $6.20.

This compact volume briefly covers the entire field of radiation as applied to gynecology and is intended as a companion to the author's *Fundamentals of Radiation Therapy.*

The first portion of the work is devoted to benign conditions. The author favors intrauterine application of radium for benign bleeding, as well as for small myomatous uteri. Beta radiation, using a small dosage (280 to 360 hours) is recommended. Radiation therapy in the menopause, endometriosis, pelvic inflammations, tuberculosis, and benign conditions of the breast are also detailed.

Malignant diseases are discussed in the second portion of the book. A thorough consideration of the conditions influencing various types of therapy prefaces this section. Carcinoma of the cervix is treated by external radiation, local implantation of radium, and vaginal tube irradiation. Surgery is recommended for carcinoma of the fundus, with radiation reserved for postoperative therapy and inoperable cases.

The author has had good results with local roentgen therapy, combined with external irradiation to the regional nodes, in carcinoma of the vulva. Carcinoma of the vagina

is treated by vaginal tube irradiation. Sections on postoperative irradiation in ovarian and mammary carcinoma are included. There is also a section upon supportive therapy, including endocrines, in the patient undergoing irradiation.

The author liberally quotes opinions other than his own. This book presents a thorough and concise presentation of its subject.

BRUCE A. HARRIS, JR.

Gynecology, Diseases and Minor Surgery. By Robert J. Lowrie, M.D. 802 pages. Springfield, Ill., 1952. Charles C Thomas. $22.50.

Dr. Lowrie's book, entitled *Gynecology,* bears the subtitle *Diseases and Minor Surgery.* It is number one of a two-volume text, the second volume of which will be subtitled *Major and Minor Gynecological Surgery.* It is the work of multiple authors, and in the entire two-volume text 79 contributors will be represented. With the exception of a single chapter on "Minor Gynecological Surgery," the present volume devotes itself to the nonsurgical aspect of the subject. Fifty-three divisions of the material have been made, and each assigned to an author in a separate chapter.

Obviously such a massive contribution cannot be reviewed in any great detail. On the one hand, there is an unevenness of presentation between the different authors and chapters which renders generalizations impossible. On the other hand, little would be gained in giving a true picture of the work by singling out individual writers either for praise or for censure. Under such circumstances a reviewer must content himself with evaluations of the volume as a whole.

In the first place, a work of this type presents certain dangers and potential traps in its organization. These are the dangers of arbitrariness in division of subject matter, disproportion between topics, repetition of topics, and even contradiction between various authors and sections. These threats have been perfectly apparent to the editor and he has obviously made an effort to avoid them. It must be confessed, however, that to some minor extent the book falls into each of these traps.

This does not invalidate the work, although it may limit its usefulness as a text for beginning students. Furthermore, the book has many of the strengths which a multiple-author work should possess:

A. Each section can be written by a man chiefly interested in that particular field. The single author cannot, in each chapter, be dealing with subject matter which is his primary interest.

B. Each section is given more adequate treatment. The total section (of three chapters) on endocrine principles represents a more complete coverage than the average text is likely to give.

These attributes give the book a completeness and authoritative note not often encountered in the usual book by one author. In its presentation of the individual disease entities the text is traditional in approach. The disease is named, defined, its incidence and histopathology given, followed by symptoms, diagnosis, and treatment. One may look up diseases, but, in general, not symptom complexes.

In its physical form the book is superb. It is printed in a large type, in two column form, on a heavy glossed paper. A particular word should be said anent the illustrations. A tremendous amount of time, effort and money has obviously gone into these, and it has been well worth it, for the illustrations throughout are of excellent quality.

In general one would hazard the prediction that this is a volume which will not become the routine textbook for a beginning course in gynecology, but that it will find a wide audience which will perhaps regard it more as a dictionary of contemporary gynecologic opinion. We look forward to the appearance of Volume II with more than average interest.

ALLAN C. BARNES

Gynecological and Obstetrical Pathology. By Peter A. Herbut, M.D. 673 pages with 428 illustrations. 246 figures and 2 color plates. Philadelphia, 1953, Lea & Febiger. $12.50.

The importance of a working knowledge of the pathological aspects of obstetrics and gynecology is recognized as important for the well-trained and informed specialist in these branches of medicine. More and more men are becoming trained as obstetrical and gynecological pathologists. It is to be expected that, with the increasing interest in this subject, textbooks on the subject would be written. The newest is the one under discussion, which is written by a professor of general pathology, although other authors have written some of the special chapters.

It is a large book of six hundred seventy-three pages. One of the interesting aspects is the portion devoted to the clinical treatment of the different lesions.

The text covers every pathological condition which occurs in obstetrics and gynecology. The bibliographies at the end of each chapter are very complete and offer excellent opportunities for further investigation. The chapters on cytology, anemias of pregnancy, and the Rh factor are welcome additions in a textbook of this type.

It is refreshing to find the term "adenoma malignum" eliminated from the classification of carcinoma of the endometrium. The author emphasizes estrogen as a possible cause of endometrial carcinoma too strongly. There is still not sufficient evidence that estrogen is carcinogenic in the human being.

There will be considerable disagreement with the statement that cesarean section should be done in cases of rising anti-Rh antibodies.

The chapter on the abnormalities of the fetal membranes is most complete and should be of great assistance to pathologists who have not had special training in this field.

The one disappointment is the poor illustrations. This is a real fault and most unfortunate, for good illustrations, especially those of the microscopic findings, are very necessary in a textbook on pathology. However, the completeness of the text partially compensates for this fault and there should be a wide demand for the book.

J. EDWARD HALL

Die Frühdiagnose des Uteruscarcinoms. By Prof. Hans Limburg, Oberartz at the University Woman's Clinic, Hamburg, Germany. Second edition, 208 pages with 83 illustrations. Stuttgart, 1952, Georg Thieme Verlag. DM 19.50.

This short volume contains a thorough review of modern methods for the early diagnosis of cervical carcinoma. Great emphasis is laid upon Stage 0.

The book is divided into two major portions. The first deals with the results of older diagnostic procedures, and the second is devoted to a study of the results obtained with vaginal smears. There are many excellent photomicrographs. A description of biochemical methods in tumor diagnosis is also included.

Although colposcopy is not widely used in this country, the author finds it an indispensable adjunct in his work. He rejects the Hinselmann classification of abnormal epithelium as viewed through the colposcope. Nevertheless, the addition of colposcopy to routine biopsy has markedly increased the author's percentage of diagnosis in Stage 0. The further addition of Papanicolaou smears to the technique has caused a sixfold increase in the percentage of diagnosis of carcinoma in situ. The author's percentage of Group I cases has been nearly doubled by using all three methods. Colposcopy is used solely as a guide to biopsy.

BRUCE A. HARRIS, JR.

Annales Chirurgiae et Gynaecologiae Fenniae. Edited by P. E. A. Bylander; Special editor for this edition, Paavo Vara. 629 pages. Vol. 38, suppl. 3. Helsinki, 1949, Mercatorin Kirjapaino.

The present volume consists of a large number of papers in English, German, and French published in honor of the fiftieth birthday of Professor Aarno Turunen, Chief of

the Women's Clinic in Helsinki, largest in Finland. The papers were contributed by his friends and pupils, and they represent a general picture of postwar obstetrical and gynecological practice in this enlightened small nation.

A wide range of material is covered, but with a minimum of experimental work. The influence of American literature is indicated by the frequent references to American workers in obstetrics and gynecology.

In a review of vaginal operations over a thirteen-year period, most of which were performed for prolapse of the uterus, no mention is made of the Manchester procedure, so popular in this country and England. Another paper describes external version with remarkable success. Two papers are presented on the serodiagnosis of uterine malignancy, indicating a lack of specificity. The first case report of vagitus uterinus in Finland is interesting because the author induced labor by "total fasting for 48 hours." A paper on endometriosis stresses the excellent results obtained by conservative surgery. A lengthy review of carcinoma of the cervix complicating pregnancy was contributed by the editor of the volume. Radical hysterectomy, followed by irradiation, is the preferred treatment.

As expected in a publication of this kind, the quality of the papers ranges from extremely poor to excellent. However, a good insight is obtained about the level of obstetrical and gynecological practice in Finland up to 1949. Most of the papers are in English, brief, and easy to read.

LAURENCE B. FELMUS

Das Vegetativ-endokrine Syndrome der Frau. By Friedrich Curtius, Chefartz der Med. Klink des Krankenhauses Ost Lubeck, and Karl-Heinz Kruger, Oberarzt der Inn. Abt. des Allg. Krankenhauses Hagen i.w. Munich-Berlin, 1952, Urban & Schwarzenberg. 120 pages with 31 illustrations and 2 tables. DM 22.

The authors describe a "vegetative-endocrine syndrome." This consists of a triad including vasolability, ovarian insufficiency, and habitual constipation. These are found to be positively correlated. The condition does not occur in males and is not primarily of endocrine origin.

Patients afflicted with this condition have a tendency to various disturbances, including hypertension and "vasomotor angina pectoris." The syndrome is frequently confused with organic illnesses including heart disease and thyrotoxicosis. Therapy includes psychiatric aid, physical therapy, and occasionally the administration of hormones.

The authors support their theory with statistical analysis derived from 3,300 cases.

BRUCE A. HARRIS, JR.

A Textbook of Gynaecological Surgery. By Victor Bonney, M.S., M.D., B.Sc.Lond., F.R.C.S.Eng., Hon. F.R.A.C.S., Hon. F.R.C.O.G., M.R.C.P.Lond. Consulting Gynaecological and Obstetric Surgeon to the Middlesex Hospital; Consulting Surgeon to the Chelsea Hospital for Women. Sixth edition, 958 pages with 611 original drawings by Victor Bonney and 17 color plates. London, 1953, Paul B. Hoeber, Inc. $16.00.

Only a gynecological surgeon with the vast personal experience of Victor Bonney could have undertaken a volume of the magnitude and scope of *A Textbook of Gynaecological Surgery*. This sixth edition of the book, which was first published in 1911 by Victor Bonney and the late Comyns Berkeley, has been revised to include the current advances in radical surgery.

In the section on vulvar operations, the author now states that "cancer of the vulva is not properly treated by simple excision." There follows a graphic description of the technique advanced by Mr. Way in the surgical treatment of this condition. The author concludes that the best results will be achieved when "all the cases [vulvar cancer] in a large area go to one institution for their treatment." The pelvic exenteration procedure developed by Brunschwig is amply described and presented as evidence of the great advancement in anesthesia, blood replacement, and fluid balance in modern surgery. Although not so stated,

the conclusions of the author concerning the surgical treatment of vulvar cancer might well apply to the pelvic exenteration and possibly the radical hysterectomy and pelvic lymph node dissection in treatment of uterine cancer. It is interesting to note that the author's radical hysterectomy for cancer of the cervix is not as extensive a procedure as developed in the United States by Meigs and Brunschwig. In discussing the difficulties and dangers of the radical hysterectomy, it is stated that the hypogastric plexus area "should always be avoided, unless the extent of the growth compels the operator to trespass upon it."

As in former editions, the author has accurately portrayed the countless operative procedures in the respective areas of the female genitourinary tract. Inasmuch as current training programs have often failed to acquaint the young gynecological surgeon with these procedures, this volume affords the gynecologist an excellent opportunity to familiarize himself with the techniques involved, especially in urinary and bowel complications.

The volume devotes a great deal of space to descriptions of instruments, methods of sterilization, sutures, duties of the staff, general postoperative complications, and so forth. The author might have employed this space to greater advantage in discussing the development and merits of the various operations or in amplifying the handling of the complications and dangers in specific operations. An unusual feature of this volume, as well as of former editions, is the fact that all of the illustrations have been sketched by Mr. Bonney himself. However, the author might have achieved greater depth, clarity, and definition by wider employment of modern professional art and photography.

The thoughts expressed by the author in his brief chapter entitled "General Operative Considerations" represent the judgment and knowledge acquired through years of experience. As such, they merit the review and meditation of all surgeons. Whether one considers this a textbook or a reference book on operative gynecology, it should be a welcome and permanent addition to the libraries of all gynecologists.

<div align="right">JOHN G. MASTERSON.</div>

Miscellaneous

Endocrine Treatment in General Practice. By Max A. Goldzieher, M.D., and Joseph W. Goldzieher, M.D., editors, and 19 other collaborators. 474 pages with 19 illustrations. New York, 1953, Springer Publishing Co. $8.00.

This book, designed for the general practitioner, covers an extremely wide range of disorders related to the endocrine system. It is dogmatic in its suggestions and is devoid of all references. The editors are father and son "endocrinologists" who have contributed several of the chapters, themselves, in collaboration with 19 other clinicians, specialists in their fields.

The book is essentially a manual of treatment and is divided into five main divisions: disorders related to age; disorders of metabolism and nutrition; disorders of organ systems; disorders of resistance; and a final chapter on currently available commercial hormone preparations.

As often occurs in a work of this type, the various chapters are curiously uneven and the influence of the editors is noted only in occasional footnotes. Clinical aspects of endocrinology are discussed only sketchily, and for each condition there is an outline of treatment with exact dosages of the various hormones that might prove useful. Many suggestions are made without any apparent factual basis and with no references to the literature. For example, in treatment of premature infants it is advocated that the anabolic effects of testosterone be utilized to improve the survival chances when the nutritional status is poor. (This has been thoroughly proved valueless by Riley and Earle in the *American Journal of Diseases of Children.*)

Techniques for pellet implantation are given, as well as for testicular and endometrial biopsies. The discussions of frigidity, virilism, and sterility are commendable. The menopause is discussed in a clear and gratifyingly sane manner.

To be deplored, however, is the advocacy of androgens in a large variety of female disorders, even in prepuberal girls. Although the possibility of virilism is mentioned, several of the authors minimize that danger by suggesting concomitant use of estrogens.

Injectable hormones are advocated in the treatment of many conditions when the oral route would be therapeutically as effective.

The conscientious busy general practitioner, with too little time for more than cursory investigation, will find this volume a handy guide for almost all conditions even remotely related to endocrinology.   LAURENCE B. FELMUS.

Sterility, the Diagnostic Survey of the Infertile Couple. By W. W. Williams, M.D. Springfield, Mass., 1953, W. W. Williams, M.D., publisher. 350 pages with 174 illustrations.

This compact and attractive volume of approximately 350 pages does just what its title purports to do, namely, it describes systematically the routine diagnostic survey of the infertile couple. The author, long an authority in this field and past president of the American Society for the Study of Sterility, says in his introduction that nearly everything is facilitated and its analysis made more thorough by a systematic method of study. He proceeds to develop a comprehensive system of surveying the infertile couple in eight visits. Not only is the reader told what to do at each visit but how to do it in detail. Sample chart forms are given and even the approximate times of the patients' appointments suggested. Nicely interwoven in the description of the routine are found special chapters such as those on interpretation of endometrial slides, "gynography," culdoscopy, and tubal salvage, all written by recognized experts in these particular fields.

The book is profusely and well illustrated, containing 174 photographs which have, incidentally, been particularly well reproduced. The format is excellent and the bibliography adequate and up to date.

This volume will make good reading both for the expert in the field and for the gynecologist to whom sterility is only an occasional problem.   LOUIS M. HELLMAN.

Obstetrics

Transactions of the Fifth American Congress on Obstetrics and Gynecology. Edited by George W. Kosmak. Published as a supplementary volume to the AMERICAN JOURNAL OF OBSTETRICS AND GYNECOLOGY, Vol. 64A, December, 1952. 599 pages with 18 illustrations. St. Louis, 1952, The C. V. Mosby Company. $12.50.

The *Transactions* are presented in book form, in an attractive format. Almost all the papers read at the Fifth American Congress on Obstetrics and Gynecology at Cincinnati in 1952 are included in this volume.

Among the numerous contributors are many of the outstanding teachers of this country and Canada, and a wide range of subjects is covered in the discussions. Notable among the more than twenty symposiums are those on Rh and Hr sensitization, lesions of the vulva, uterine carcinoma, obstetric hemorrhage, and the toxemias of pregnancy. There are also sections on the public health aspects and nursing aspects of obstetrics, fetal salvage, and neonatal deaths, reflecting a modern trend.

Many of the papers presented have been published in special journals and are probably familiar to the majority of specialists. However, the volume presents a good review of the current approach to many obstetrical and gynecological problems, and should be useful to residents and interested general practitioners, as well as to others who would like a good refresher course in obstetrics and gynecology.   LAURENCE B. FELMUS.

The 1952 Year Book of Obstetrics and Gynecology. Edited by J. P. Greenhill. 575 pages with 98 figures. Chicago, 1952, The Year Book Publishers, Inc. $5.50.

The 1952 Year Book of Obstetrics and Gynecology contains a review of carefully selected articles published between July, 1951, and June, 1952. It makes remarkably good

reading, containing a particularly representative series of reviews in both obstetrics and gynecology. There are 253 pages devoted to obstetrical subjects, 159 to gynecological reviews. As usual, the author's remarks are cogent and reveal an extensive knowledge of the literature pertaining to his specialty. The reviews dealing with carcinoma of the cervix, its diagnosis and treatment, are particularly timely and demonstrate the great interest in this particular phase of gynecology. Likewise, the section on infertility is representative and pertinent. Louis M. Hellman.

A Nurse's Handbook of Obstetrics. By E. C. Zabriskie and N. J. Eastman. Philadelphia, 1952, J. B. Lippincott Co. Ninth edition, 695 pages with 377 illustrations and 8 color plates. $4.75.

The ninth edition of what must be recognized as one of the leading textbooks in the field of obstetric nursing has just been published. The preceding edition is now four years old. The present text is approximately the same size as its predecessor and contains 377 illustrations. It is divided into six major units, namely, human reproduction, nursing in pregnancy, nursing during labor and delivery, nursing during the puerperium, the neonatal period, additional maternity information. After each one of these major sections there is a section devoted to conference material and another to situation questions. These latter are well thought out and prove stimulating. One of the remarkable things about this text is that its senior author, in spite of the fact that she has not been associated with active obsterical nursing for many years, has kept remarkably abreast of the times. The text contains some discussion of most of the modern developments in obstetrics. There are, however, a few areas where lack of familiarity with the rapidly progressing field is evident. This is particularly true in the section on anesthesia and analgesia, where old and obsolete anesthetic equipment is demonstrated in the illustrations and some of the text deals with methods of anesthesia no longer prevalently used. The same criticism can be directed at the section on uterine inertia.

Many of the illustrations are superb, particularly those done by Miss Ranice Birch. However, some of the older illustrations have been too long retained and appear somewhat dated.

This book is entitled *A Nurse's Handbook of Obstetrics.* However, as such, it has outgrown its handbook status. Too many interesting and new facets in obstetrics have been added without removal of some of the old and obsolete material. In order to retain all of this material without increasing the size of the volume, the editors have given their text a crowded appearance. The type is too small to permit ease of reading, especially for the student to whom many of the words and much of the material are new. The double columns of the text do not leave a pleasing impression.

In spite of this criticism, this book remains one of the outstanding nursing texts on obstetrics in the English language. There is much in it that is thought provoking and it must serve as a stimulus to any nurse who uses it to learn this specialty. Louis H. Hellman.

Progress in the Prevention of Needless Neonatal Deaths. By H. N. Bundesen, E. L. Potter, W. I. Fishbein, F. C. Bauer, and G. V. Plotzke. 272 pages with 31 illustrations. Reprinted from Annual Report of the Chicago Health Department, 1951.

This report covers a study under the auspices of the Chicago Health Department, which is unique in the extent and intensity of effort. It is likely to evoke a variety of reactions in the readers, depending not only on their field of activity, but also on the type of practice in which they are engaged. The results and recommendations may seem trivial to those who work at first-rate hospitals or medical schools. Yet one should realize that the majority of infants are not born at these institutions. Accordingly, much of the effort of Bundesen and co-workers has been devoted, not so much to the advancement of knowledge, as to the dissemination of existing information. This is evident from the

introduction where five points are listed: (1) if the causes of infant deaths were known; (2) if all infants had been given "known accepted treatment and care from the very start"; (3) if health authorities had assumed their full share in appraising conditions and contributed to the solution of the problem; (4) if pregnant women of lower socioeconomic status had taken advantage of existing facilities; and (5) if methods used in other public health activities had been utilized to make certain that these women receive antepartum care—then the neonatal mortality rate could have been lowered. This has been accomplished to some extent during the latter years of the Chicago project.

Of particular interest to obstetricians is a wealth of statistical information on factors operating in the mother, at birth, and in the infant in their relation to neonatal death. There is a study of the causes of death during the first month of life, divided among seven principal groups as follows: abnormal pulmonary ventilation, 43.7 per cent; injuries at birth, 16.6 per cent; malformations, 15.8 per cent; infections, 13.4 per cent; blood dyscrasias, 5.3 per cent; anoxia, 3.8 per cent; and miscellaneous, 1.4 per cent. To this reviewer, the figures appear to be misleading, particularly since they suggest that birth injury is a cause of death more than four times, and infection more than three times as often as anoxia. This disagreement with the experience of many other authorities is explained by the fact that some of the seven categories are closely interrelated, and not mutually exclusive. It is known, for instance, that intracranial hemorrhage as well as early postnatal pneumonia may be sequelae of anoxia. It is doubtful that any system as simple as that used by Bundesen and co-workers can do justice to the problems involved in neonatal death.

Two sections deal with the manner in which health officers, in cooperation with hospitals and their staffs, can improve and properly maintain the conditions under which the overwhelming majority of babies are born.

In its present form, this report should be very useful to public health agencies, hospital administrators, and those supervising clinical services. In addition, the material on which it is based has yielded important scientific information in the hands of E. L. Potter on previous occasions, and will doubtless continue to do so.

B. G. GRUENWALD.

Books Received

TITLE	AUTHOR	PUBLISHER
Medical Progress	Ed. Morris Fishbein	The Blakiston Company
Office Psychiatry	L. G. Moench	The Year Book Publishers, Inc.
Anales del Instituto de farmacologia espanola		Instituto de Farmacologia Espanola, Madrid
Patologia Obstetricia	Jose Botella Llusia	Editorial Cientifico
Il Diritto Alla Nascita	Sebastino di Francesco	Editrice Studium, Rome
Blood Sugar of Newborn Infants	Jorgen Pedersen	Danish Science Publisher, Press L & D, Copenhagen
Obstetrica Practica Version	Juan Lean	El Ateneo, Florida 340, 1952. Buenos Aires. 96 ills.
Das Inselsysten des Pankreas	Helmut Ferner	Georg Thieme Verlag, Stuttgart, 1952, 54 ills.
The Scalp in Health and Disease	Howard T. Behrman	The C. V. Mosby Company, St. Louis, 1952. 566 pages, 312 ills.

Selected Abstracts

EDITED BY GEORGE W. KOSMAK, M.D., NEW YORK, N. Y.

Cancer, Malignancies

Ayre, J. Ernest: Regression of Cervical Carcinoma in Situ Following Aureomycin, South. M. J. **45:** 915, 1952.

Carcinoma in situ is a special stage of epidermoid carcinoma of the cervix. It is believed to result directly from chronic inflammation or infection with or without virus, in tissues which have been exposed to estrogen stimulation. There are many factors and a multiplicity of causes leading to cancer but infectious agents certainly seem to be one of these. Cancer in situ is a neoplastic infectious process which is yet not fully autonomous.

A small series of patients showing in situ cancer have been treated by the vaginal administration of aureomycin. Approximately one-half of the in situ lesions investigated have responded to aureomycin although in some cases regression was temporary. Even so, it is an entirely new concept to think of cancer undergoing regression by virtue of exposure to antibiotic treatment.

Invasive cancer was studied in six cases and in no case was there response to or regression under aureomycin therapy.

The author does not claim that aureomycin is a cure for cancer for none of the invasive lesions, even the very early ones, responded by regression. However, it does appear that worth-while research along this path may be pursued by clinician and cytologist and knowledge of the malignant process augmented.

WILLIAM BICKERS

Jones, W. N., Blanton, G. C., and Hagood, M.: Endometrial Carcinoma, Am. Surgeon **18:** 913, 1952.

After an extremely brief review of the literature the authors present a small series of cases of corpus cancer. They cite opinions in the literature that condemn the use of intrauterine radium for benign uterine bleeding, and concur in this disapproval, after which they express their approval of preoperative uterine packing with radium in corpus cancer. These beliefs are supported by individual case reports from their series. The scant data presented do not permit evaluation of these treatments from their own material.

S. B. GUSBERG

Heyman, J., and Segerdahl, C.-O.: Evaluation of Results of Treatment in Cancer of the Uterine Cervix, Acta obst. et gynaec. Scandinav. **31:** 365, 1951.

The authors discuss methods that are applicable in therapeutic statistics for evaluating the results of treatment in cervical carcinoma. The basic premise is that no treatment results may be profitably assessed before a five-year interval has elapsed from the time of the initial treatment. Three varieties of apparent recovery rate are used in statistical representation of treatment results. The ''absolute'' recovery rate is the proportion of apparently recovered patients expressed as a percentage of the total number examined with a view to treatment, whether they are treated or not. The ''over-all relative'' apparent recovery rate is the proportion of apparently recovered patients expressed as a percentage of the total number actually treated. The ''stage'' rate is the proportion of apparently

recovered patients expressed as a percentage of the total number in that stage actually treated. Professor Heyman indicates that the absolute apparent recovery rate is of great value, but can be applied by only a limited number of institutions. The over-all relative rate is unsuitable for comparative purposes and therefore unacceptable. The stage rates, therefore, actually constitute the only available means for comparing the results of treatment at various institutions. The obvious disadvantages of this purely clinical method are enumerated: the lack of uniformity in the interpretation of criteria; varying degrees of skill and experience among examining clinicians; and differences of interpretation among examining clinicians independent of their skill and experience. The suggestion is made that a satisfactory uniformity might be obtained if clinicians would adhere to the adopted general rule: ''When it is doubtful to which stage a given case is to be referred, the earlier stage should be chosen.'' In the estimation of the five-year absolute recovery rate, patients examined but not treated are to be regarded as dead, since there appear to be no patients with cervical cancer reported in the literature as having survived the first five-year period without treatment. In order to evaluate different methods of treatment by comparing absolute rates, one must assume that in the series to be compared all acceptable patients be offered treatment without any delay that would unreasonably aggravate the condition; or, alternately, the degree of aggravation of such delayed cases must be similar. The proportion of patients refusing treatment in any two series to be compared must also be similar for the conclusions to be statistically valid. Where such conditions do not exist, differences will occur in the absolute rates which are not due to the methods of treatment used, and this would endanger the validity of the statistics for evaluation of treatment efficacy. Correction for intercurrent deaths should be made only if ''intercurrent death'' is rigorously defined as death definitely resulting from some condition which can be safely regarded as unconnected with the treated carcinoma. These basic criteria are adhered to in the senior author's *Annual Report on the Results of Radiotherapy in Carcinoma of the Uterine Cervix;* this paper is an ancillary explanatory essay to be used in connection with Heyman's very valuable periodic reports from Radiumhemmet in Stockholm.

DOUGLAS M. HAYNES

Schjøtt-Rivers, E.: Can the Results of Irradiation in Cancer of the Uterine Cervix Be Improved by Prophylactic Hysterectomy? Acta obst. et gynaec. Scandinav. 31: Supp., 1951.

Review of the various combinations of therapeutic methods that have been used for the treatment of cancer of the uterine cervix indicates that, on the whole, irradiation has given the most satisfactory results to date. The author considers the question of whether these results might be improved by the so-called ''prophylactic hysterectomy'' advocated by Hultberg and others. The purpose of this procedure is (1) to prevent local recurrence, and (2) to remove nonradiosensitive tumors as early as possible. Laparotomy is also claimed to be purposeful because it makes possible the diagnosis of nonpalpable metastases, and this information may be useful in subsequent irradiation. The term ''prophylactic'' hysterectomy applies to an operation performed at a time prior to that at which the results of the primary irradiation can be assessed.

The author performed such operations on 116 patients at the Norwegian Radium Hospital. Poor operative risks were not subjected to the procedure, and the primary operative mortality was less than 1 per cent. The operation elected was a simple total hysterectomy, and *not* a radical Wertheim dissection as suggested by Hultberg. Twenty per cent of the operations were performed vaginally, most of these patients being elderly, obese, or suffering from complicating lesions of various types. The operations followed complete radium treatment after subsidence of the postirradiative syndrome, but long before the result of the irradiation is known. Careful histologic study of the operative specimens was done.

In 22 per cent of the uteri removed, there was histologic evidence of tumor. One hundred of the patients were observed over a period of 5 years or longer; the remaining 16 patients were observed only for 2½ to 5 years. Twenty-four of the patients observed for

5 years or more succumbed; one patient of the short-term group had died at the time of publication. In the absence of adequate control material, the evaluation of these results is problematic, but the author cautiously concludes that the percentage of cure in the operative cases tends to be somewhat higher than in those patients receiving irradiation alone. Definitive evidence in favor of this idea would consist, of course, of a much more extensive experience.

<div align="right">Douglas M. Haynes</div>

Netto, Pedro Ayres: Cancer of the Endometrium, An. brasil. de ginec. 31: 209, 1951.

The author in this paper analyses the incidence of cancer of the endometrium in his clinic at São Paulo, and finds that among a series of 1,263 cases of cancer of the uterus, only 8 cases of cancer of the body of the uterus were found. This incidence of 1:158 is below the world statistics.

Etiology of corpus cancer is discussed, particularly its relation to endometrial hyperplasia and endometriosis. In the Clinic of the Institute of Viera de Carvalho among 19 cases of cancer of the endometrium only one case of endometrial hyperplasia was found.

A general survey of uterine tumors observed at the clinic is reported. Among a total of 15,800 pathological examinations 1,838 uterine tumors were found: 1,263 were cancer of the cervix, 305 were fibroids, and there were 256 cases of glandular hyperplasia of the endometrium. The highest incidence of cancer of the endometrium was in the age group between 50 and 60 years, after the menopause.

The author favors surgical treatment preceded by intracavitary radium, and statistics showing results of this treatment are quoted.

<div align="right">Ricardo L. Gorbea</div>

Cesarean Section

Pommerenke, W. T.: Cesarean Sections: A Twenty-five-year Survey in a Teaching Hospital, New York State J. Med. 52: 2785, 1952.

The author presents the results in all of the cesarean sections performed in the twenty-five year period of its operation in the Department of Obstetrics and Gynecology of the University of Rochester.

A total of 682 operations were performed, an incidence of 2.2 per cent of all deliveries.

The indications for operation were numerous and varied as is the case in modern obstetrics with the general broadening of indications for this operation. The most frequent indication was that of a previous cesarean, 13.8 per cent, closely followed by contracted pelvis, 10.4 per cent, and antepartum hemorrhage due to premature separation of the placenta, 6.6 per cent, or placenta previa, 5.0 per cent.

There were 7 maternal deaths, a maternal mortality of 1 per cent, and, of these, 3 deaths were very definitely not due to the operation, but rather to underlying factors present.

There were 26 (3.9 per cent) stillbirths, and 33 (5.1 per cent) neonatal deaths. Of the stillbirths, the majority were due to premature separation of the placenta which was the indication for the operation. More than half of the neonatal deaths were due to prematurity or atelectasis.

The paper is of particular interest in presenting the entire cesarean section experience of a clinic first opened in 1926 down to the present time.

<div align="right">Karl M. Wilson</div>

Ansbro, F. Paul, Gordon, Charles A., Bodell, Benson, and Latteri, Francis S.: Epidural Anesthesia for Cesarean Section, New York State J. Med. 52: 1901, 1952.

The author first reviews the various forms of anesthesia (general, local, spinal) for cesarean section with a comparison of hazards involving both mother and baby. A detailed description of epidural anesthesia, with reasons for its use, namely, less spinal headache,

less risk of grave neurologic complications, and less fall in blood pressures, is given, with special reference to the epidural space and an outline of the technique of epidural block. Schematic drawings illustrate by cross section the spinal column with special emphasis placed on the three ligaments to be traversed prior to reaching the epidural space. A photograph of the necessary equipment to carry out this procedure is also shown.

The results of 125 cesarean sections performed by various operators under epidural block anesthesia are discussed. No maternal mortality and no headaches were encountered. Any drop in blood pressure which occurred was usually gradual and therefore more readily controlled.

All anesthesia for the epidural block was given by trained anesthesiologists, thereby placing this form of anesthesia in a more specialized class, not for general use in all cesarean sections.

E. C. HUGHES

Ectopic Pregnancy

Pisani, Bernard J.: Management of Ectopic Pregnancy With Massive Intraperitoneal Hemorrhage and Shock, Surg., Gynec. & Obst. 95: 149, 1952.

In a very timely and succinct paper the author points out the need for immediate operation to control hemorrhage associated with ectopic pregnancy, even in the face of severe shock. This is contrary to the old teaching, that patients in shock should not be operated upon, but stems from one of the real surgical lessons of the last war. There were 322 patients at Bellevue operated upon for ruptured ectopic pregnancy during the last 13 years with but one death, and that due to infection. Of these, there were 35 who presented signs of massive intraperitoneal hemorrhage and shock. These were treated as follows: (1) immediate surgery (average interval between admission and operation 3.2 hours); (2) concurrent supportive therapy and blood replacement; (3) cyclopropane anesthesia.

The efficiency of this routine is attested to by the fact that there were no deaths among this group of severely ill patients.

LOUIS M. HELLMAN

Endocrinology

Oelbaum, M. H.: The Variability of Endocrine Dysfunction in Postpartum Hypopituitarism, Brit. M. J. 2: 110, 1952.

Vagueness and confusion regarding diagnosis and treatment in postpartum hypopituitarism still exist. Diagnostic criteria are in part to blame. Six cases due to postpartum pituitary necrosis are described. An analysis of the biochemical findings showed marked variation in the degree of impairment of function of gonads, adrenal cortex, and thyroid. The author feels that a diagnosis of mild hypopituitarism may be made even when most of the laboratory findings are normal. One of the cases described showed merely a deficiency of gonadotropin excretion, the thyroid and adrenocortical function being normal. If an early diagnosis of partial pituitary necrosis is to be made one cannot wait for all the clinical and biochemical characterizations of Simmond's disease. Clinical features are of greater importance in the diagnosis of partial anterior pituitary failure.

RALPH W. GAUSE

Llusia, J. B.: The Third Gonad in a New Scheme of Sexual Regularization, Rev. mex. de cir. ginec. y cáncer 20: 111, 1952.

The author in this paper refers to a portion of the suprarenal cortex as the ''third gonad,'' this portion being an independent functional unit, with characteristic staining properties. Recently this portion, which is deep and close to the medulla, has been observed to react to the hydrazine compounds similar to the 17-ketosteroids and possibly to

estrone. The author considers this third gonad as a blastoma that develops in the absence of hormonal secretory activity of the ovary or testicle, endowed with vicarious secretory properties of sexual hormones. This tissue is specifically stimulated by the gonadotropins, especially the chorionic gonadotropin. This reaction has been demonstrated in experimental animals through the direct histologic examination of the tissue, and in man through circumstantial evidence. The author ends his paper with the statement that the ovary, pituitary, and sexual cortex constitute a compensated system of endocrine balance, through which sexual secretory activity is assured, adapting itself to the demands of the organism.

RICARDO L. GORBEA

Gynecology

Jeffcoate, T. N. A., Baker, K., and Martin, R. H.: Inefficient Uterine Action, Surg., Gynec. & Obst. 95: 257, 1952.

The author of this article has been, for many years, one of the authorities on, and one of the principal investigators into, the question of uterine dysfunction. The present paper is a lengthy one and is so full of pertinent data that little justice can be done it by this short review. In essence, the present paper is a compilation of 277 cases of inefficient uterine action.

Abnormal uterine action is divided by the author into the following categories: (1) hypotonic inertia (internal pressure of less than 25 mm. of mercury), (2) hypertonic states, (3) asymmetrical uterine action, and (4) cervical dystocia.

While the author states that this grouping is perhaps an oversimplification, it represents a very nice working summation of the known clinical and experimental data.

The over-all incidence of uterine dysfunction in the author's experience is between 0.8 and 1.4 per cent.

The most common form of uterine dysfunction is the hypotonic state. The author emphasizes the importance of accurate diagnosis indicating quite clearly that pituitary stimulation can not only be useless in the face of the hypertonic states but may indeed be dangerous. He has had little success with the sympatholytic drugs in the treatment of this latter abnormality.

It would seem from these figures that inefficient uterine action is almost entirely a disease of primigravidas, although not so definitely confined to elderly primiparity as was formerly thought. Most interesting is the following table.

TABLE IX

	NO. CASES	PER CENT
Cases (80) Treated by Cesarean Section.—		
Further conception avoided	33	41
Involuntary sterility (2 years or more)	8	
Further pregnancies	38	
Died from intercurrent disease	1	
Cases (67) Treated by Forceps Delivery.—		
Further conception avoided	25	37
Involuntary sterility (2 years or more)	5	
Further pregnancies	37	

This chart contains data on the remote effects of uterine inertia on the childbearing careers of 147 women followed from 3 to 13 years. Interestingly enough, there seems to be little difference in whether the inert labor is terminated by cesarean section or by vaginal delivery. There is a definite limitation of future pregnancy by 37 to 41 per cent in these cases.

Finally, there has been a very real improvement in fetal mortality in this condition over the past 20 years, dropping from a high of 40 to 80 per cent to a rate of 1 to 15 per

cent in recent data. All of this reflects a better, although far from complete, understanding of uterine inertia plus an improvement in general obstetric care and a more liberal use of cesarean section.

This reviewer, as one who has done some work in this field, cannot help but indicate the essential worth of this paper and recommend its careful perusal by obstetricians.

<div align="right">Louis M. Hellman</div>

Johnson, C. Gordon, Collins, Conrad C., and Webster, Herman B., Jr.: Pelvic Abscess, South. M. J. 45: 926, 1952.

The authors present an intensive review of their clinical and laboratory experiences with 93 patients suffering tubovarian or ovarian abscesses. In addition they have given an excellent résumé of the evolution of gynecologic thinking in the treatment of pelvic infections.

The symptoms which brought these patients suffering with pelvic abscesses to the hospital were in the order of frequency: pain, fever, and uterine bleeding. Failure to seek prompt hospital care or medical attention was quite noticeable in the majority of cases and probably explains in many instances the development of pelvic abscesses. About half of the 93 patients had received no treatment prior to their hospital admission.

Cul-de-sac puncture was employed in 32 instances. Its importance as a diagnostic aid can hardly be overstated. Material removed from the abscess at the time of puncture or laparotomy rarely reveals on culture the true etiological agent. It is felt that the gonococcus is predominantly the offending organism but it is well known that this bacterium disappears from the exudate within a few days after the acute infection begins. *Escherichia coli* was the organism usually obtained from culture. This undoubtedly is a secondary invader. Treatment consisted of primary surgery which included total hysterectomy and salpingo-oophorectomy in the majority of patients. Posterior colpotomy was employed in 25 per cent of the cases. There were only 7 cases in the entire group of 93 which responded satisfactorily to any medical program. Extraperitoneal drainage was done in 7 cases and in 2 it was preceded by extraperitoneal packing to wall off the abscess.

The mortality was only 0.93 per cent. It is believed that the sulfonamides and the antibiotics have not materially decreased the frequency of tubovarian abscesses. However, if these drugs were employed during the first five to seven days of acute pelvic infection it is probable that their effect would be noted. There is no doubt that their use preoperatively and postoperatively has helped considerably to reduce morbidity and mortality in patients with pelvic abscesses.

Only pointing abscesses were drained through the vagina. Those adherent to the abdominal wall should be drained by extraperitoneal approach.

<div align="right">William Bickers</div>

Louros, N. C., and Kairis, N. M.: Ovarian Dysfunction and Hepatocholecystopathy in Association With Retrodisplacement of the Uterus, Brit. M. J. 2: 20, 1952.

Attention is drawn to the retroflexed and/or retroverted uterus, either primary or secondary, which may cause a persistent backache, lower abdominal pains, and menstrual disorders. In many of these cases, rather marked symptoms of dysfunction of the liver and bile have been noticed, indicating a possible correlation between the two conditions. The usual symptoms consist of a dislike of fats, a heavy stomach, particularly after intake of eggs and chocolate, a feeling of tiredness, frequent yawning, sometimes a jaundiced color, indigestion, chronic constipation, and tenderness of the liver area.

It is felt that there is a connection between the clinical picture and the fact that both the liver and the bile are the main regulating agents in the supply of estrogens; also that a dysfunction of the liver and bile may be accompanied by a hypersecretion of estrogens which may explain the menstrual disorders in these cases.

A discussion is given as to the proper evaluation, diagnosis, and treatment of retrodisplacement with and without hepatocholecystopathy. In the latter case, the estrogen

content is above normal and often metropathia and/or mastopathy are present, whereas the various tests of the functions of the liver and bile may be either positive or negative. These conditions disappear in most cases after ventrofixation with no additional treatment if the hepatogenic syndrome is due to retrodisplacement. The operative procedure preferred is Bumm's modification of Doléris' method, which consists of suturing the round ligaments behind the rectus muscles, followed by suture of the vesicouterine fold at the rear surface of the uterus which is felt to have certain advantages over other techniques.

ELMER E. KRAMER

Pickles, Vernon R.: Cutaneous Reactions to Injection of Progesterone Solutions Into the Skin, Brit. M. J. 2: 373, 1952.

A group of thirty volunteers were injected intradermally with 0.04 ml. of each of the two following solutions: (1) Progestin, 1 mg. per cubic centimeter in ethyl oleate; (2) Progestin, 25 mg. per milliliter. The reactions were as follows: There was an immediate stinging sensation and widespread flare which developed within a minute. This reaction subsided during the first day and there was little evidence of the injection until the seventh day when a small patch of follicular eczema appeared. This progressed, reaching its peak on the fourteenth day, at which time a patch of pigmentation appeared at the area of injection. The pigmentation persisted in most cases for some weeks though the eczema-like reaction subsided during the next several days. Approximately one-third of the patients showed a second episode of eczematous follicles and wheals during the third week after injection.

Ethyl oleate alone was injected intradermally into the skin of one person. The initial response could be caused by injection of the medium alone. The later eczematous reaction appeared but no pigmentation appeared. The evidence suggests that the initial response and the eczematous reaction in the second week are nonspecific responses to the ethyl oleate. The greater intensity of pigmentation at the site of injection of the concentrated solution and possibly the whole of the second eczematous reaction seemed to depend upon the presence of progesterone in the injected solution.

WILLIAM F. FINN

Antunes, A., and Carlos: Adrenal-like Tumor of the Ovary, An. brasil. de ginec., March, 1951.

The authors present a case of masculinizing type of adrenal-like tumor of the ovary in a 39-year-old diabetic patient. For two years previous to operation the patient had noticed growth of hair on the face and body, baldness, hoarseness, and an abdominal tumor. On operation a bilateral ovarian tumor was found together with uterine fibroids. Following operation the masculinizing symptoms subsided but the patient died one and one-half years later of diabetic coma. There was no recurrence of tumor at this time.

The authors discuss the main symptoms including, besides masculinization and defeminization, high blood pressure, polycythemia, and the diabetes. It is interesting to note that this was a bilateral hypernephroid type of ovarian tumor associated with uterine fibroids which clouded the diagnosis because of intermittent uterine bleeding.

RICARDO L. GORBEA

Salvatore, Carlos A.: The Endometrium in Functional Uterine Bleeding, An. clin. ginec. Fac. med. Univ. São Paulo 4: 59, 1950-1951.

The author reports 70 cases of functional uterine bleeding of the hyperfunctional type in patients ranging from 20 to 52 years of age. The endometrial specimens were obtained by curettage during the bleeding phase, and all of them were studied histologically.

It was found that cystic glandular hyperplasia of the endometrium was present most frequently in that age group in which menometrorrhagia is more prone to occur, viz., between 35 and 45 years.

Glandular cystic hyperplasia of the endometrium was observed with almost the same frequency in patients under and over 40 years, 61.9 and 71.4 per cent, respectively. Normal or hyperplastic secretory endometrium was found more often in women over 40 years of age, 72.7 per cent.

The histological picture of the endometrium was divided in these 70 cases of functional uterine bleeding as follows: (1) normal endometrium, 17.7 per cent; (2) hyperplastic endometrium, 17.1 per cent; (3) cystic glandular hyperplasia, 65.7 per cent.

Cystic glandular hyperplasia of the endometrium was found in 2 cases with normal cycles and functional sterility, in 10 cases of myoma of the uterus, and once in a case of adenocarcinoma of the uterus. This indicates to the author that bleeding bears no relationship to the histological pattern. It seems that both elements can coexist side by side and are brought about by excess of estrogenic substances.

RICARDO L. GORBEA

Bagnati, E. P., and Bur, G. E.: Leukoverrugoma of the Vulva, Bol. Soc. de obst. y ginec. de Buenos Aires 31: 59, 1951.

The authors present a case of leukoverrugoma of the vulva in all its facets. This condition is a very rare aftermath of leukoplakia of the vulva. The world literature is very poor in papers on this entity. Being a precancerous lesion it should be treated with radical methods. The authors advise a total vulvectomy as the only method of approach. The pathology is explained as papillary degeneration of the leukoplakic tissues.

RICARDO L. GORBEA

Schwarz, F.: A Case of Lithopaedion in a Central African Woman, Brit. M. J. 2: 131, 1952.

A lithopedion with a crown-rump measurement of 17.7 cm. was discovered accidentally in an African Nyasa woman at necropsy. Skull measurements indicated that the pregnancy may have been of about 29 weeks' duration. The lithopedion was found free in the abdominal cavity and there were no scars in the normal-appearing Fallopian tubes. There was no tissue resembling placenta.

R. GORDON DOUGLAS

Corner, George W.: The Events of the Primary Ovarian Cycle, British M. J. 2: 403, 1952.

In the twenty-first Husley Lecture, delivered at Charing Cross Hospital, London, in May, 1952, Dr. Corner summarizes the present knowledge of the events of the primate ovarian cycle and substantiates his statement with an abundance of experimental proof. The author first points out that there are two basic events in the cycle of every mammalian female: (1) the maturation and discharge of the ovarian follicle, by which the corpus luteum is formed and the progestational phase of the reproductive cycle initiated, and (2) retrogression of the corpus luteum which brings that phase to an end.

It is stated that there is a difference in the outward expression of the two events of the cycle between the human species and other common mammals. In the latter, it is the ovulation phase that makes itself evident by estrual excitement and in many species by cyclic changes in the external genitals. In the human female the event of ovulation is not marked by any outwardly observable sign, nor by a surge of erotic responsiveness. However, in the human being, the end of the progestational phase is marked by a conspicuous event, namely, menstruation, while in other mammals the end of this phase is inconspicuous.

In the Rhesus monkey and other mammals the peak of sexual responsiveness occurs shortly before ovulation, although under special conditions the female may receive the male at any time. In the human being, sex behavior is so largely controlled by psychological factors that any remainder of cyclic sex rhythmicity is inconspicuous. There seems to be a peak of sex response in the human female immediately premenstrually or postmenstrually—a biologically inefficient condition.

Considering next the maturation of the follicle, the author states from experimental evidence that it would appear that at about day 9 of the typical 28 day cycle, counting from the onset of the last menstrual flow, one of the waiting follicles on the ovary begins to enlarge under hormone stimulation and grow from 2 to 3 mm. in diameter to the full size of 15 mm. in 3 or 4 days, finally rupturing and discharging its ovum. With respect to the cycle length of 28 days, which in both species is the model length, ovulation may occur on any day from day 6 to day 20, with high frequencies from day 12 to day 15. After ovulation the next event of the cycle is transportation of the ovum to the uterus. The author feels that the chief function of the Fallopian tube is to delay the journey of the ovum until the corpus luteum has had time to prepare the uterus for its reception. The human embryo implants itself in the uterus as early as the seventh day after ovulation.

The postovulatory phase, in the absence of conception, is as irregular as the preovulatory phase. The span from ovulation to the onset of subsequent menstruation may vary from 7 to 22 days. Evidently there are significant variations in the rate of biological and physiological retrogression of the corpus luteum, causing a variation in the time of effective progesterone withdrawal, or in the rate at which the endometrium responds to the hormonal deprivation by menstrual breakdown.

Finally, the events of the anovulatory cycle are discussed. It is stated that nonluteal cycles often occur in ostensibly healthy women.

WILLIAM P. GIVEN

Muhlbock, O.: **Experimental Research on the Genesis of Ovarian Tumors,** Geburtsh. u. Frauenh. **12:** 289, 1952.

Very little is understood of the development of ovarian tumors, since the experimental production of these tumors in animals is difficult and the histological study of human tumor development is open to criticism and doubt. Experimentally, in the rat and mouse, such tumors can be produced by one of several methods: (1) x-ray, (2) homoovarian transplants into the spleen, and (3) anastomoses of ovariectomized and normal animals. Study of ovarian tumors by this latter method was employed experimentally. The procedure followed was to join together by means of abdominal grafting several such animals and observe the results obtained. The author found that after several days the blood supply of such grafted animals commingled. By means of this method he felt that changes of endocrine function in one would be followed by tumor production of the other. Thus, when a castrated female was anastomosed with a normal female rat, the effects of castration, with its increase of pituitary function, would be reflected on the ovary of the intact animal. He first noted that the gonadotropins remained equal in both animals, but that the estrogen production of the normal did not affect the estrogen level of the castrate. Eventually there was an increase in the pituitary hormones in both because of the uninhibited pituitary of the castrate. This occasionally produced ovarian tumor growth in the normal animal but results were not conclusive since many of the animals died and in the remainder the adrenals took over the estrogen function in the castrate. To overcome this he joined together two castrates and one normal animal. Results with this procedure were better than with previous experiments but still not good. However, when he made homotransplants of the normal ovary into the spleen he was able to produce regular tumor development after two castrates had been joined to the transplanted animal.

Results obtained showed that by x-ray stimulation granulosa tumors were produced, by homotransplantation of the ovary luteomas occurred, and that with homotransplantation plus anastomoses, tubular adenomas occurred. He explains the results obtained as follows: in the oophorectomized animals, inhibition of the pituitary secretion is lost by the loss of estrogen. A similar effect is produced by the transplantation of the ovary into the spleen in the normal animal, since all estrogen produced in this animal is destroyed by the liver. Thus a tremendous amount of gonadotropin is present which acts as a direct stimulator of the transplanted ovary, thus producing tumor growths in that organ. The author states that these tumors are histologically indistinguishable from those removed from human beings.

L. B. WINKELSTEIN

Gynecologic Operations

Nogues, A. E., Guixa, H. L., and Otturi, J. E.: An Analysis of 1006 Hysterectomies, Bol. Soc. obst. y ginec. Buenos Aires **31:** 91, 1952.

The authors in this paper review 1,006 hysterectomies of all types and arrive at the following conclusions: (1) The type of operation used should be decided by the type of condition present and the general condition of the patient. (2) The mortality and morbidity with total and subtotal abdominal operations show no fundamental variations when compared with reliable statistics. (3) It is preferable to use the total procedure in patients close to the menopause for benign uterine condition, thus avoiding future complications with the remaining uterine neck stump. (4) Supravaginal (supracervical) hysterectomies are favored in the younger patients if the disease present allows it. (5) Vaginal hysterectomies are preferred to any other procedure when possible because of their lowered mortality and morbidity rates.

The paper is illustrated with many charts and tables which review the mortality and morbidity of every case operated upon. Indications for operations as well as operative complications are tabulated. The bibliography contains 47 references.

RICARDO L. GORBEA

Doyle, James C.: Unnecessary Ovariectomies, J. A. M. A. **148:** 1105, 1952.

The author reports the removal of 704 normal ovaries in 546 cases from private hospitals in Los Angeles and adjacent cities. Of the 704 ovaries removed, 336 (47.17 per cent) had no cystic formation and were reported as normal. Of the normal variations there were 137 (19.4 per cent) follicular cysts, 123 (17.5 per cent) corpus luteum cysts, and 90 (12.8 per cent) examples of corpus hemorrhagicum. Fourteen (1.9 per cent) were of the senile, atrophic, sclerotic, or fibrotic type, and there were 4 retention or inclusion cysts (0.6 per cent). The author does not support the theory of prophylactic ovariectomy at a specified age to prevent cancer but if he did the age would be about 50 years. In many cases where normal ovaries were removed the preoperative diagnosis was indeterminate or in doubt. The most common clinical diagnoses were inflammatory disease, cystic ovaries, and pelvic endometriosis. The author calls for extreme care and diligence in preoperative diagnosis and extreme conservatism in pelvic surgery where ovariectomies are concerned.

WM. BERMAN

Menstruation

Påhlsson, Nils Erik: Endocrine Therapy in the Treatment of Functional Amenorrhea and Functional Oligohypomenorrhea, Acta obst. et gynaec. Scandinav. **31:** 109, 1952.

The hospital records of 384 women with functional amenorrhea and functional oligohypomenorrhea admitted to the Karolinska Sjukhuset in Stockholm during the period 1943 to 1948 constitute the basis of this study. The diagnosis of primary amenorrhea was made in any patient who had reached the age of 17 years without onset of menstruation. Secondary amenorrhea was considered to be present when a woman who had previously menstruated had noted cessation of the menses for 6 months or longer, pregnancy obviously being excluded. Of these 384 women, 282, or 73 per cent, had been unsuccessfully treated by various forms of hormonal therapy before inclusion in this series, and thus were patients having a presumptively poor prognosis from the start.

Routine general physical examination was performed on all the patients, with special reference to stigmas of endocrine diseases; and each patient was subjected to a diagnostic curettage before treatment was instituted. Therapeutic results were controlled by periodic endometrial biopsies. Hormonal assays were employed to a limited extent only, but a few selected patients were studied with respect to urinary excretion of estrogens, gonadotropic hormones, and 17-ketosteroids. Four general methods of therapy were used: estrogenic therapy alone, estrogenic therapy combined with progesterone, gonadotropic therapy, and implantation of calf hypophysis.

Forty-three patients between the ages of 16 and 32 years were treated for primary amenorrhea. In 8 of these patients, no developmental abnormalities of the genitals or

general body habitus were present. Estrogen therapy was successful in producing normal menses in 5 of these women. Thirty-five patients with amenorrhea of primary type had some evidence of genital or systemic infantilism; estrogen therapy and calf hypophysis implantaticn produced normal menses in only 6 patients in this group. Of the total of 11 patients in the primary amenorrhea group who seemed to benefit from therapy, 3 subsequently became pregnant (7 per cent of patients in this series).

One hundred ninety-two patients between the ages of 16 and 42 fell into the category of secondary amenorrhea. In 87 of these women (45 per cent), hormonal treatment resulted in establishment of normal menstrual function. The author's experience confirms the generally held view that the prognosis in patients with secondary amenorrhea of functional type depends far more on the duration of the condition than it does on the age of the patient. Of 53 patients treated with parenteral preparations of crystalline chorionic gonadotropin, 38 per cent experienced re-establishment of normal menses. A history of delayed menarche did not appear to be a significant predisposing factor in any of the patients in this series. Therapeutic results were uniformly unsatisfactory in all patients in whom the excretion of gonadotropic hormone in the urine was found to be higher than normal. The conclusion to be drawn from the entire series is that endocrine therapy is sometimes of value in functional amenorrhea, provided the reproductive organs are normally developed, and the ovarian lesion is not too severe.

DOUGLAS M. HAYNES

Salvatore, Carlos A.:   Capillary Fragility and Menstruation, Surg., Gynec. & Obst. **95:** 13, 1952.

The author studied capillary fragility in 50 women of varying ages. He indicates an increase in fragility in the early days of menstruation. Whether or not the slight differences shown by the investigator are statistically significant is not stated.

LOUIS M. HELLMAN

Vespasiano Ramos, A., and Peano, Marcel: Report on Eighteen Cases of Functional Amenorrhea, An. brasil. de ginec., January, 1952.

The authors report 18 cases of functional amenorrhea, 5 primary and 13 secondary. After a detailed description of the laboratory and clinical picture, the authors present a therapeutic plan which has been very successful in their hands. They employed stilbestrol, 80 mg. a month for the primary types, together with 30 mg. of progesterone during the same time.

For the secondary type the authors use a combination of estrone sulphate in varying doses in conjunction with indicated doses of progesterone, stilbestrol and ethinyl-estradiol. They also use estradiol monobenzoate in 1 mg. doses as an intrauterine infiltration. The authors found that stilbestrol was beneficial in most of the secondary types of amenorrhea. There is no bibliography.

RICARDO L. GORBEA

Tubal Insufflation

Davis, M. E., Ward, M. E., and King, A. G.:   An Evaluation of the P.S.P. (Speck) Test for Tubal Patency, Fertil. & Steril. **3:** 217, 1952.

The authors have evaluated this test of tubal patency which utilizes the detection of phenolsulfonphthalein in the urine following its injection into the uterus as the criterion of peritoneal absorption. This test was compared with the standard ones of insufflation and utersalpingography in a series of 110 patients with an error for the P.S.P. (Speck) test of 15 per cent noted.

These investigators discuss the possibility of P.S.P. absorption from traumatized or diseased mucous membranes in uterus and tubes, and conclude that this test offers no advantages over the standard procedures in the study of female sterility by the gynecologist. It is, however, an ingenious and simple test and may find some field of usefulness.

S. B. GUSBERG

Correspondence

Conflicting Conclusions on Uterine Contractility

To the Editors:

I would like to point out an inaccuracy that appears in the article entitled "Dysmenorrhea" by Drs. Norman F. Miller and S. J. Behrman (the JOURNAL of March, 1953, vol. 65, no. 3, page 508). The authors state that the observations of Chassar Moir on uterine contractility were confirmed by E. Novak and S. R. M. Reynolds, among others. This statement is contrary to the facts.

The paper of Novak and Reynolds referred to appeared two years before Moir's article. (The latter was published in 1934 and not in 1933 as stated in Miller and Behrman's list of references.) The conclusions of Novak and Reynolds on the influence of the female sex hormone (or theelin) and progestin on uterine motility were based on studies in rabbits with uterine fistulas. Moir's investigations, on the contrary, were made on women and the conclusions he reached were exactly the opposite of those of Novak and Reynolds. As additional evidence of the wide variance in their views is the exchange of letters between Reynolds and Moir in the *Lancet* (2: 1415, 1934, and 1: 53, 1935).

LEO WILSON, M.D.

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NEW YORK CITY
APRIL 25, 1953

Reply by Dr. Miller

To the Editors:

We find that Dr. Wilson's points are correct. However, the error on our part does not alter our concept regarding dysmenorrhea. I am sorry that the mistake was made and appreciate Dr. Wilson's calling it to my attention.

NORMAN F. MILLER, M.D.

UNIVERSITY HOSPITAL
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Observations on Technique, Applicability, and Comparative Evaluative Studies of Sponge Biopsy in Cancer Diagnosis

To the Editors:

Within a period of 4 years after the publication of my first paper on ''Sponge Biopsy in Cancer Diagnosis''[1] there appeared in the AMERICAN JOURNAL OF OBSTETRICS AND GYNE-COLOGY four separate[2,3,4,5] publications by different authors dealing with sponge biopsy as applied to the diagnosis of uterine cancer. This interest on the part of investigators and readers is deeply appreciated by me, and I take this occasion to express my gratitude, and hope that the interest will be sustained and accompanied by further progress. In the early stages of development of a new method, because of the time lag between the study of accumulated data and its appearance in print, investigations begun four years ago and now reported may be out of date, especially with regard to technique, sphere of application, and expected results. Accordingly, I wish to record a few more recent observations which I hope will prove helpful to those practitioners who wish to use sponge biopsy as an aid in cancer detection and diagnosis, and especially to those investigators who may have the opportunity to make studies of critical appraisal or comparative evaluation in relation to exfoliative cytology and surgical biopsy.

228

First, there is a fundamental difference between exfoliative cytology and sponge biopsy. Exfoliative cytology depends on the study of cells spontaneously cast off from epithelial surfaces into secretions of tubes or cavities. The lesion in question may be out of reach of the examiner. Sponge biopsy depends primarily on the study of tissue particles mechanically removed from the surface of the lesion by rubbing of a suitable sponge over the area in question. Sponge biopsy, therefore, requires *direct contact with the lesion,* which must be within reach. It is a form of surface biopsy. It is similar to surgical biopsy, employing a sponge instead of a knife. It obtains for microscopic examination many tiny tissue particles from the surface of the lesion. The amount of material collected depends on the friability of the lesion as well as on the abrasive and absorptive action of the sponge.

From this statement it is obvious that one cannot do a sponge biopsy of a vaginal or endometrial lesion by rotating a piece of sponge in the cervical canal[5]; the sponge must be rubbed over and in direct contact with the lesion in the vagina or endometrium. Diamond, Mitchell, and Blum[4] have published a paper on endometrial sponge biopsy, using an instrument for introduction of the sponge into the uterine cavity, enabling them to diagnose four cases of endometrial carcinoma subsequently confirmed.

Of course, a sponge can be used to soak up secretions and cellular fluids, and after fixing the sponge and preparing paraffin sections, the cytology of the fluid may be studied. This, however, is not sponge biopsy as we have defined, described, used, and recommended it. This procedure would be better defined as exfoliative cytology using a sponge-paraffin technique. This technique has its virtues and in some laboratories is used to supplement smears for cytological study. It cannot be called sponge biopsy, however, because it differs in the nature of the material and the manner of collection.

In view of these considerations one may ask, "Is it possible to compare sponge biopsy with exfoliative cytology?" The answer is, "Yes, provided both methods are applicable and correct techniques are used, and provided the two methods do not reciprocally influence each other." For example, the two methods may be compared with respect to the diagnosis of cancer of the cervix because the cervix can be reached by the sponge and because exfoliated material from the cervix is available in the vaginal vault. However, if one uses a swab for insertion into the cervical canal to obtain "cervical secretion" for smears, this is no longer exfoliative cytology. Contact of the swab with the cervical epithelium, especially when a friable, cellular cancer is present, will inevitably rub off superficial tissue particles which are then transferred to the slide. Thus, surface biopsy has been introduced. The smear material here is a mixture of exfoliative cytology and surface biopsy. The difference is easily seen by comparing the early and later photomicrographs of "exfoliative cytology" of the cervix, before and after the introduction of abrasive techniques. Tissue particles seen in the latter are not seen in the earlier publications.

Furthermore, sponge biopsy of the cervix requires rubbing the sponges over the entire epithelial surface of the cervix, i.e., canal and lips. At least two sponges must be used, one for·canal and one for lips. It is preferable to use two for each area, *making four sponges in all, each sponge rubbed firmly on both sides,* to absorb as much tissue juice and as many tissue particles as possible. In our publication of 1949[6] we pointed out that the gelatin sponge is defective for sponge biopsy purposes because it is delicate and fragile. Others have experienced the same difficulty. Accordingly we have tried several different sponges and have come to use exclusively a specially prepared cellulose sponge (Onkosponge No. 1). This sponge does not tear; it holds its shape; it has excellent absorptive power; it cuts easily with the microtome; and, most important, it has good abrasive power, permitting firm rubbing and the absorption of abundant tissue for examination.

For purposes of comparison the two tests must be done so as not to influence each other either favorably or unfavorably. If the cytological studies are made on fluid aspirated from the vaginal vault without touching the cervix, this procedure may be carried out without influencing the sponge biopsy of the cervix which is performed immediately

thereafter. It would be a serious error to perform the sponge biopsy first, because this procedure will inevitably alter the cellular content of the vaginal secretion.

The simplicity of sponge biopsy has encouraged an indifference to details of technique which decreases the accuracy obtainable by this method. The details of the technique are given in the article in the J. A. M. A., Apr. 21, 1951, vol. 145, pp. 1238-1244. We would emphasize the following points: (1) use the special cellulose sponge exclusively, (2) use at least four pieces of sponge on each test, (3) rub sponges on both sides firmly over canal and lips of cervix uteri, especially over ulcerations or discolorations when present, (4) absorb as much tissue fluid and as many tissue particles as possible into the sponges, (5) have the technician recover and process all free floating particles in formalin bottle as described in the J. A. M. A. article, (6) always do sponge biopsy when surgical biopsies are done. Sponges and tissue block may be placed in the same bottle of 10 per cent formalin. In a significant number of cases, the sponge biopsy has been positive when the surgical biopsy was falsely negative. The surgical biopsy takes tissue from a small and limited area. The sponge biopsy removes tissue particles from the entire surface of the lips and cervical canal of the cervix. This is especially important in the early cases when no lesion is visible or the area of the lesion is poorly defined.

Rich, Angrist, and Carpenter[2] have been impressed with the time-saving features of sponge biopsy, the absence of false positives, and the ability of the pathologist to read the slides without special training. They found sponge biopsy and exfoliative cytology "to be worthy adjuncts in the diagnosis of carcinoma of the cervix." Walker and Curphey[5] conclude that the two methods "are valuable additions to our techniques in the study of gynecological cancer." We are indebted to these authors for their willingness to investigate a method, new and untried, and devote so much time and effort to these studies. We also appreciate their favorable comments. The studies of Gladstone and Selzer,[7] using improved techniques, indicate that sponge biopsy of the cervix can achieve an accuracy approaching 100 per cent. I am convinced from an extensive experience that any practitioner, technician, and pathologist can achieve similar results if a reasonable effort is made to follow the recommendations here made. Should any investigators making a systematic study fail to achieve these results after they have learned the technique, I should be glad to advise them as to possible sources of error, either by mail or personally as circumstances permit.

SIDNEY A. GLADSTONE, M.D.

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APRIL 29, 1953

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ROSTER OF AMERICAN OBSTETRICAL AND GYNECOLOGICAL SOCIETIES*

(Appears in January and July)

American Academy of Obstetrics and Gynecology. (1945) *President,* Robert A. Kimbrough, Jr., Philadelphia, Pa. *Secretary,* C. Paul Hodgkinson, 104 S. Michigan Ave., Chicago 3, Ill. Next meeting, Netherland Plaza Hotel, Cincinnati, Ohio, Dec. 14, 15, and 16, 1953.

American Gynecological Society. (1876) *President,* Richard W. Te Linde, Baltimore. *Secretary,* John I. Brewer, 104 S. Michigan Ave., Chicago 3, Ill.

American Association of Obstetricians, Gynecologists and Abdominal Surgeons. (1888) *President,* Nicholson J. Eastman, Baltimore, Md. *Secretary,* William F. Mengert, 2211 Oak Lawn, Dallas 4, Texas. Annual meeting at Hot Springs, Va., Sept. 10, 11, and 12, 1953.

Central Association of Obstetricians and Gynecologists. (1929) *President,* William O. Johnson. *Secretary,* Harold L. Gainey, 116 S. Michigan Ave., Chicago 3, Ill. Annual meeting, Shamrock Hotel, Houston, Texas, Nov. 5, 6, and 7, 1953.

South Atlantic Association of Obstetricians and Gynecologists. (1938) *President,* H. Hudnall Ware, Richmond, Va. *Secretary,* John C. Burwell, Jr., 416 Jefferson Bldg., Greensboro, N. C. Next meeting, Hollywood Beach Hotel, Hollywood Beach, Fla., Jan. 14, 15, and 16, 1954.

A. M. A. Section on Obstetrics and Gynecology. *Chairman,* B. J. Hanley, 1930 Wilshire Blvd., Los Angeles, Calif.

Society of Obstetricians and Gynaecologists of Canada. (1944) *President,* W. G. Cosbie, Toronto, Ont. *Secretary,* Robert B. Meiklejohn, Medical Arts Bldg., Toronto, Ont. Next meeting, Harrison Hot Springs, B. C., June 10-13, 1954.

Akron Obstetrical and Gynecological Society. (1946) *President,* Harold Klingley. *Secretary,* Charles V. Bowen, Jr., 925 Second National Bldg., Akron 8. Meetings, third Friday of month, October, January, April, and July.

Alabama Association of Obstetricians and Gynecologists. (1940) *President,* John Hope. *Secretary,* O. M. Otts, Mobile. Meetings, November and April.

Alameda County Gynecological Society. (1951) *President,* Ernest W. Henderson. *Secretary,* Charles F. Lewis, 3023 Summit St., Oakland, Calif. Meetings, fourth Wednesday of each month, except June, July, and August.

Birmingham Obstetrical and Gynecological Society. (1949) *President,* M. Y. Dabney. *Secretary,* Wade Cline, 2018 Fifteenth Ave., S., Birmingham. Meetings, quarterly.

Boston, Obstetrical Society of. (1861) *President,* Benjamin Tenney, Jr. *Secretary,* A. Gordon Gauld, 1180 Beacon St., Brookline 46, Mass. Meetings, third Tuesday in October, November, January, February, and March, Harvard Club, Boston.

Bronx Gynecological and Obstetrical Society. (1924) *President,* Mark Daniel. *Secretary,* Alex Charlton, 1749 Grand Concourse. New York 53, N. Y. Meetings, fourth Monday, October, November, January, February, March, and April.

Brooklyn Gynecological Society. (1890) *President,* Charles H. Loughran. *Secretary,* Leslie H. Tisdall, 615 Third St., Brooklyn 15. Meetings, third Wednesday, October, November, January, February, March, April, and May.

Buffalo Obstetrical and Gynecological Society. (1946) *President,* Harry LaForge. *Secretary,* Louis A. Trippe, 511 Lafayette Ave., Buffalo. Meetings, first Tuesday, October through May.

Central New York Association of Gynecologists and Obstetricians. (1938) *President,* Michael J. Elwood. *Secretary,* Vincent J. Hemmer, Medical Arts Bldg., Syracuse. Meetings, third Tuesday, September, November, February, and May.

Chicago Gynecological Society. (1878) *President,* Edward M. Dorr. *Secretary,* Edwin J. DeCosta, 104 S. Michigan Ave., Chicago 3. Meetings, third Friday, October through June, Hotel Knickerbocker.

Cincinnati Obstetrical Society. (1876) *President*, Richard D. Bryant. *Secretary*, Robert R. Pierce, 116 William Howard Taft Rd., Cincinnati 19. Meetings, third Thursday, September through June.

Cleveland Society of Obstetrics and Gynecology. (1947) *President*, G. Keith Folger. *Secretary*, Eduard Eichner, 10465 Carnegie Ave., Cleveland 6. Meetings, fourth Monday, September, November, January, March, and May.

Columbus Obstetric-Gynecologic Society. (1944) *President*, Robert Daly. *Secretary*, Leonard B. Greentree, 350 E. Broad St., Columbus 15. Meetings, last Wednesday of month, September through May.

Dallas-Fort Worth Obstetric and Gynecological Society. (1948) *President*, W. P. Devereux. *Secretary*, Oran V. Prejean, 4317 Oak Lawn Ave., Dallas 19. Meetings, spring and fall.

Dayton Obstetrical and Gynecological Society. (1937) *President*, E. W. Smith. *Secretary*, M. V. Lingle, 1040 Fidelity Bldg., Dayton 2. Meetings, third Wednesday, September through May.

Denver Gynecological and Obstetrical Society. (1942) *President*, Joseph von Detten. *Secretary*, Raymond Chatfield, 1809 E. 18th Ave., Denver 6. Meetings, first Monday of month, September through June.

El Paso County Obstetrical and Gynecological Society. (1948) *President*, Erich Spier. *Secretary*, Alvin L. Perry, 209 Medical Arts Bldg., El Paso. Meetings quarterly.

Florida Obstetric and Gynecologic Society. (1948) *President*, Dorothy D. Brame. *Secretary*, J. C. Taylor, 1022 Park St., Jacksonville. Meetings, December and April.

Georgia State Obstetrical and Gynecological Society. (1951) *President*, Hugh Bickerstaff, Columbus. *Secretary*, Eugene L. Griffin, Atlanta. Meetings semiannually.

Honolulu Obstetrical and Gynecological Society. (1947) *President*, Lyle G. Phillips. *Secretary*, James T. S. Wong, 1415 Kalakaua Ave. Meetings, third Monday of each month at the Mabel Smyth Memorial Bldg.

Houston Obstetrical and Gynecological Society. (1939) *President*, T. R. Hannon. *Secretary*, Murphy D. Stevenson, 807 Hermann Professional Bldg., Houston. Meetings, first Tuesday each month, October through June.

Indianapolis Obstetrical and Gynecological Society. (1947) *President*, Foster Hudson. *Secretary*, Paul F. Muller, 3311 N. Meridian St., Indianapolis. Meetings, January, April, and October.

Interurban Obstetrical and Gynecological Society. (1949) *President*, Merton C. Hatch, Syracuse, N. Y. *Secretary*, E. R. Duggan, 16 N. Goodman St., Rochester 7, N. Y. Meeting, Oct. 3, 1953.

Iowa Obstetric and Gynecologic Society. *President*, D. J. Lutton. *Secretary*, William C. Keettel, State University of Iowa Hospitals, Iowa City. Meetings, spring and fall.

Kansas City Gynecological Society. (1922) *President*, H. M. Floersch. *Secretary*, James E. Keeler, 4301 Main St., Kansas City, Mo. Meetings, fourth Thursday, September, November, January, and March, and first Thursday in May.

Kentucky Obstetrical and Gynecological Society. (1947) *President*, Clyde Sparks, Ashland. *Secretary*, J. B. Marshall, Louisville.

Los Angeles Obstetrical and Gynecological Society. (1914) *President*, E. W. Cartwright. *Secretary*, A. N. Webb, 3130 W. 6 St., Los Angeles 5. Meetings, second Tuesday, September, November, January, March, and May.

Louisville Obstetrical and Gynecological Society. *President*, Glenn W. Bryant. *Secretary*, J. O. H. Simrall, Heyburn Bldg., Louisville. Dinner meetings, fourth Monday, September, October, November, January, February, March, April, and May.

Madison Obstetrical and Gynecological Society. (1950) *President and Secretary*, Fred A. Brown, 110 E. Main St., Madison, Wis. Meetings, first Tuesday each month except July, August, and September.

Maryland, Obstetrical and Gynecological Society of. (1929) *President*, John Whitridge. *Secretary*, W. Drummond Eaton, 11 E. Chase St., Baltimore 2. Meetings, second Thursday, October, December, February, and May.

Memphis Obstetrical and Gynecological Society. (1950) *President*, M. J. Roach, Jr. *Secretary*, William F. Mackey, 1374 Madison Ave., Memphis. Meetings, fourth Friday, October, November, January, March, and May.

Miami Obstetrical and Gynecological Society. (1946) *President*, Ralph Jack. *Secretary*, Henry Caffee, Douglas Entrance, Coral Gables. Meetings, second Thursday, January, March, May, and November.

Michigan Society of Obstetricians and Gynecologists. (1924) *President*, Harold H. Lampman. *Secretary*, C. Paul Hodgkinson, 2799 W. Grand Blvd., Detroit 2. Meetings, first Tuesday, October through May.

Minnesota Obstetrical and Gynecological Society. *President*, John A. Haugen. *Secretary*, Rodney F. Sturley, 350 Saint Peter St., St. Paul. Meetings, spring and fall.

Mississippi Obstetrical and Gynecological Society. (1947) *President*, William B. Wiener, Jackson. *Secretary*, J. A. K. Birchett, Jr., The Street Clinic, Vicksburg. Meetings May and October.

Mobile Obstetrical and Gynecological Society. (1949) *President*, G. J. Mitchell. *Secretary*, C. Buerger, 1456 Springhill Ave., Mobile. Meetings, second Thursday, January, April, July, and October.

Montana Obstetrical and Gynecological Society. (1946) *President*, S. W. Preston. *Secretary*, Leonard G. Brewer, Higgins Bldg., Missoula. Next meeting, Billings, Mont., April, 1954.

Nassau Obstetrical Society. (1944) *President*, Arthur F. Wright. *Secretary*, David E. Warden, 22 Oakwood Road, Huntington, N. Y. Meetings, second Monday, every other month, September through May.

New England Obstetrical and Gynecological Society. (1929) *President*, Joel M. Melick, Worcester, Mass. *Secretary*, Carmi R. Alden, 270 Commonwealth Ave., Boston 16, Mass. Meetings, April 29 and October 28, 1953.

New Jersey Obstetrical and Gynecological Society. (1947) *President*, Albert B. Davis. *Secretary*, Felix H. Vann, 242 Engle St., Englewood. Meetings, October and April.

New Mexico Obstetrical and Gynecological Society. (1947) *President*, C. S. Shortle. *Secretary*, W. E. Rapp, 4800 Gibson Ave., S.E., Albuquerque. Meetings, October, November, January, March, and May.

New Orleans Obstetrical and Gynecological Society. (1924) *President*, E. W. Nelson. *Secretary*, Abe Mickal, 1413 Richards Bldg., New Orleans 12. Meetings held October, November, January, March, and May.

New York Obstetrical Society. (1863) *President*, Samuel A. Cosgrove. *Secretary*, Henry S. Acken, Jr., 34 Prospect Park West, Brooklyn 15. Meetings, second Tuesday from October through May.

North Carolina Obstetrical and Gynecological Society. (1932) *President*, C. H. Mauzy, Jr., Winston-Salem. *Secretary*, Adam Thorpe, Rocky Mount. Meetings, December and April.

North Dakota Society of Obstetrics and Gynecology. (1938) *President*, Carl Baumgartner. *Secretary*, John Gillam, 807 Broadway, Fargo. Meetings, spring and fall.

Northeastern New York Obstetrical and Gynecological Society. (1935) *President*, William B. Van Auken. *Secretary*, Rudolph F. Amyot, 71 Second St., Troy, N. Y. Meetings, third Thursday of January, May, and October.

Oklahoma City Obstetrical and Gynecological Society. (1940) *President*, Thomas C. Points. *Secretary*, W. K. Hartford, 201 Pasteur Medical Bldg., 1111 N. Lee St., Oklahoma City 3. Meetings bimonthly, September through May.

Omaha Obstetrical and Gynecological Society. (1947) *President*, John Grier. *Secretary*, Leland Olson, 1107 Medical Arts Bldg., Omaha 2. Meetings, third Wednesday, January, March, May, September, and November.

Oregon Society of Obstetricians and Gynecologists. *President*, James M. Whitely. *Secretary*, William O. Thomas, Jr., 1735 N. Wheeler Ave., Portland 12. Meetings, third Friday, October through May.

Pacific Coast Obstetrical and Gynecological Society. (1931) *President*, Theodore W. Adams. *Secretary*, Donald G. Tollefson, 511 S. Bonnie Brae St., Los Angeles 5. Meeting, Oct. 21-24, 1953.

Pacific Northwest Obstetrical and Gynecological Association. (1947) *President*, William M. Wilson, Portland, Ore. *Secretary*, R. D. Reekie, W. 407 Riverside Ave., Spokane 1, Wash. Meeting, June, 1954, Portland, Ore.

Philadelphia, Obstetrical Society of. (1868) *President*, Benjamin Leff. *Secretary*, Paul O. Klingensmith, 133 S. 36th St., Philadelphia 4. Meetings, first Thursday, October through May.

Pittsburgh Obstetrical and Gynecological Society. (1934) *President*, David Katz. *Secretary*, William E. Gibson, 1010 Center St., Pittsburgh 21. Meetings, first Monday, October through May.

Portland Society of Obstetricians and Gynecologists. *President*, Jack W. Dowsett. *Secretary*, George H. Lage, 453 Medical Arts Bldg., 1020 S. W. Taylor St., Portland 5, Oregon. Meetings, fourth Wednesday, September through June.

Queens Gynecological Society. (1948) *President*, William Filler. *Secretary*, George Schaefer, 98-11 Queens Blvd., Forest Hills, N. Y. Meetings, second Wednesday, October, December, February, and April.

Rochester Obstetrical and Gynecological Society. (1939) *President*, Louis Iuppa. *Secretary*, Fred Fumia, 39 N. Goodman St., Rochester, N. Y. Meetings, September, December, March, and June.

St. Louis Gynecological Society. (1924) *President*, Leo Hartnett. *Secretary*, W. H. Vogt, Jr., Metropolitan Bldg., St. Louis. Meetings, second Thursday, October, December, February, and April.

San Antonio Obstetrical and Gynecological Society. *President*, G. G. Passmore. *Secretary*, Frank M. Posey, Jr., 640 Moore Bldg. Meetings, first Monday of the month.

San Diego Gynecological Society. (1937) *President*, John W. Wanless. *Secretary*, James Ravenscroft, 2330 First Ave., San Diego 1.

San Francisco Gynecological Society. (1929) *President*, Donald W. de Carle. *Secretary*, Edmund F. Anderson, 2445 Ocean Ave., San Francisco 27. **Meetings, second Friday, October through April, Sir Francis Drake Hotel, San Francisco, or Claremont Country Club, Oakland.**

Seattle Gynecological Society. (1941) *President*, Hugh H. Nuckols. *Secretary*, Robert H. Stewart, 1340 Madison, Seattle 4. Meetings, third Wednesday of each month, September through June.

South Carolina Obstetrical and Gynecological Society. (1946) *President*, Wesley J. Snyder, Jr. *Secretary*, Frank B. C. Geibel, 1517 Hampton St., Columbia 1.

Southwest Obstetrical and Gynecological Society. (1951) *President*, Lee M. Miles. *Secretary*, Jesse A. Rust, Jr., 3115 University Ave., San Diego 4, Calif. Annual fall meeting, October, 1953, Albuquerque, N. Mex.

Texas Association of Obstetricians and Gynecologists. (1930) *President*, D. D. Wall, San Angelo. *Secretary*, Carey Hiett, 815 Fifth Ave., Ft. Worth. Meeting, Waco, Texas, February, 1954.

Utah Obstetrical and Gynecological Society. (1948) *President*, M. S. Sanders. *Secretary*, Von G. Holbrook, 508 East South Temple, Salt Lake City 2. Meetings, to be announced.

Virginia Obstetrical and Gynecological Society. (1936) *President*, John R. Kight. *Secretary*, Chester D. Bradley, 2914 West Ave., Newport News. Meetings, April and October.

Washington Gynecological Society. (1933) *President*, Samuel Dodek. *Secretary*, J. B. Sheffery, 1801 K St., N. W., Washington, D. C. Meetings, fourth Saturday, October, November, January, March, and May.

Washington State Obstetrical Association. (1936) *President*, Philip Kyle, Tacoma. *Secretary*, Robert Campbell, Stimson Bldg., Seattle 1. Meetings, April and October.

Wisconsin Society of Obstetrics and Gynecology. (1940) *President*, George H. Stevens. *Secretary*, Dean D. Willson, 92 East Division St., Fond du Lac. Meetings, May and October.